DEMAND SIDE MANAGEMENT: ASSESSMENT OF CONCEPTS, METHODS, NEED, BENEFITS AND CHALLENGES

By

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Further, I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for award of any degree. In my opinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfilment for the award of degree of MBA.

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ABSTRACT

Energy efficiency has been long recognized and accepted as a resource that, when balanced with new generation and other supply options, contributes to the country's growing electricity needs. Since electrical energy is the form of energy that cannot be effectively stored in bulk, it must be generated, distributed and consumed immediately. But load on the power plant is variable in nature. The power plants are designed to meet the maximum demand. However, there is large difference between peak demand and average demand which results in high generation cost per unit. Since peak demand is increasing sharply that demand large installed capacity. It is not possible for developing countries to meet the targeted capacity by installing new power plants. Regulated utilities have had to experiment with alternative program strategies in their efforts to meet increasingly aggressive targets and to coalesce around new market players. Since electricity is an essential input in all the sectors of any country, hence we need to focus on alternating means by which electricity can be saved and effectively utilized.

The effective solution to above said problem is DSM strategies that lower the peak demand and bring immediate benefit to utilities and customers. During the last fifteen to twenty years, DSM -- with this or other designation -- has made an invaluable contribution to sustainable development, allowing growth to be simultaneous with environment protection. The theory and practice behind DSM is actually fundamental to the Market Transformation concept, which relies on the action of both regulators, economic agents and consumers to achieve an energy efficient economy through education, technology replacements and adequate building and energy management

There are different types of DSM measures that can reduce energy demand for the end-user, that can manage and control loads from the utility side, and that can convert unsustainable energy practices into more efficient and sustainable energy use.

This paper deals with the basic concept of Demand Side Management (DSM), objective, problems, DSM methods, the need for DSM so that electricity demand could be reduced at consumer end through effectively control and manage loads from utility side, the benefits and challenges of DSM.

CHAPTER 1: INTRODUCTION

This project covers "demand-side management" or DSM, as applied to energy efficiency measures that modify or reduce end-users' energy demand. This has traditionally been applied to electricity loads but is also used for changes that can be made to demands for all types of energy. The benefits for the energy user are reduced energy costs for a given output (production level or other measure of activity). For the energy provider, the benefit is a better use of its supply capacity.

From a utility point of view it would seem that a sensible business approach would be the promotion of consumption thereby increasing sales. This would be true if there were an excess of capacity and revenues were the only important factor in an energy supply system. However, increased revenues does not translate necessarily in higher profits and in some situations a least-cost planning approach would/could prove the implementation of DSM measures to be more profitable than investing in new generating capacity. Utilities might therefore be better advised to promote DSM and energy saving. From an environmental perspective, a decrease in energy demand due to improved efficiency reduces the environmental impact of energy consumption associated with a particular level of production or other activity. In this respect, promoting DSM can thus enhance the public image of a utility company.

The objective of DSM is to reduce the peak electricity demand and promoting the energy efficient devices. In fact to reduce the overall load on electrical network, total consumption and peak demand can be reduced by:

- Improving the load curve
- Energy Conservation

Benefits of DSM

Utility economic benefits-

- Reduction in excess cost for meeting peak load requirement
- Reduction in Line Losses
- Increase in effective system capacity

Customer economic benefits-

- Reduction in Energy Consumption
- Low Operating Cost
- Better equipment performance
- Longer equipment life

1.1 OVERVIEW

The DSM strategies have the objective of maximizing the end use efficiency to avoid/ postpone the requirement of new generating capacity. In DSM three concepts are clearly identified: Demand Response, Energy Efficiency and Energy Conservation

Demand-side management (DSM) has been traditionally seen as a means of reducing peak electricity demand so that utilities can delay building further capacity.It's the process of managing energy consumption to optimize available and planned resources for power generation. DSM incorporates all activities that influence customer use of electricity and results in the reduction of the electricity demand, which are mutually beneficial to the customers and the utility.

In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability. Possible benefits can also include reducing dependency on expensive imports of fuel, reducing energy prices, and reducing harmful emissions to the environment. Finally, DSM has a major role to play in deferring high investments in generation, transmission and distribution networks. Thus DSM applied to electricity systems provides significant economic, reliability and environmental benefits.

When DSM is applied to the consumption of energy in general—not just electricity but fuels of all types—it can also bring significant cost benefits to energy users (and corresponding reductions in emissions). Opportunities for reducing energy demand are numerous in all sectors and many are low-cost, or even nocost, items that most enterprises or individuals could adopt in the short term, if good energy management is practised.

1.2 BACKGROUND

Demand for any commodity can be modified by actions of market players and government (regulation and taxation). Energy demand management implies actions that influence demand for energy. DSM is originally adopted in electricity, today DSM is applied widely to utility including water and gas as well.

Reducing energy demand is contrary to what both energy suppliers and governments have been doing during most of the modern industrial history. Whereas real prices of various energy forms have been decreasing during most of the industrial era, due to economies of scale and technology, the expectation for the future is the opposite. Previously, it was not unreasonable to promote energy use as more copious and cheaper energy sources could be anticipated in the future or the supplier had installed excess capacity that would be made more profitable by increased consumption.

In centrally planned economies subsidizing energy was one of the main economic development tools. Subsidies to the energy supply industry are still common in some countries.

Contrary to the historical situation, energy prices and availability are expected to deteriorate. Governments and other public actors, if not the energy suppliers themselves, are tending to employ energy demand measures that will increase the efficiency of energy consumption.

DSM is also known as Energy Side Management or Energy Demand Management whose ultimate aim is to reduce the peak demand of power plant. DSM has different means for different categories of peoples. For utility company, DSM means avoiding or delaying the need to construct new generating capacity by reduction or shift of consumer's energy use period . For domestic consumer, DSM means an opportunity to save money by reducing their electricity bill taking the advantage of financial incentive provided by utility. For industrial customers, DSM would translate to lower production cost and more competitive product. In other words, DSM refers to steps taken by utility and consumer on meter side to change the amount or timing of energy consumption.

The concept of demand-side management (DSM) has been introduced in the USA (after the energy crisis in 1973), more specifically in the electricity industry, in the mid-eighties.

The trend towards highly regulated DSM in the USA, actually forcing utilities to adopt certain decisions though with the guarantee of financial compensation, shows in itself that these instruments have been considered of high societal value. DSM has been identified since the infancy of the concept as a privileged tool for utilities to contribute to the societal goal of environment protection -- besides being profitable on its own in many cases. In view of this advantage, in some countries regulations have been issued and accompanying procedures implemented that sought to maintain economic advantage for the utilities while promoting energy efficiency on the demand side.

<u>DSM facts in the United States-</u>

• In 1999 in the United States, 459 large electricity utilities had DSM programs.
These programs saved the large utilities 50.6 billion kilowatt hours (kWh) of energy generation. This represented 1.5 per cent of the annual electricity sales of that year.
• New York has the potential to reduce demand by 1,300 MW
• DSM—enough to supply power to 1.3 million homes.

The Indian power sector has more than tripled its installed capacity, from 30,000 MW in 1981 to over 100, 000 MW in 2001. Despite this growth in supply, its power system is struggling to overcome chronic power shortages and poor power quality. With the demand exceeding supply, severe peak (around 18%) and energy (around 10%) shortage continue to plague the sector. In 1991, IPP proposal exceeds 150,000 MW, while in 2001, just 3,500 MW of IPP power was actually operational. Even if captive market capacity addition of 1500-2000 MW per year is included, a total capacity addition of not more than 6,000 MW a year over the next 4-5 years is only expected. This translated into

US$6 billion of investment and several million tons of additional pollutants but would still not close enough to meet the targeted capacity increases.

Ever increasing demand for electrical energy has become a notable feature of modern civilization for quite some time now, we find them in situation, where the gap between the demand and supply of electrical energy is continuously widening. We are not able to meet the energy demand. The gap between demand & supply of electric energy is widening at the rate of 3% day by day. Bridging this gap by setup of new power plant is very difficult & expensive proposition. This situation is not likely to improve in immediate future. As we know that electricity is an important input in all the sectors of any country's economy, hence need to find alternate methods to reduce peak demand and to save electricity. Electricity shortages are exacerbated by inefficiencies mainly in end-use system. The inefficiencies in the end use system is due to irrational tariffs, technology obsolescence of industrial processes and equipment, lack of awareness, nascent energy services industry and inadequate policy drivers. The only value way in handling these crises is to overcome these inefficiencies in end uses that is possible with Demand Side Management Strategy.

Numerous studies in China and other countries have found that cost effective DSM programs can reduces the electricity use and peak demand by approximately 20-40%. In India, great opportunities for reducing energy demand using DSM are available in all the sectors, many are low cost, or even individual can adopt them that help to reduce the electricity demand and per unit generation cost, improving reliability and environment and social improvement.

1.3 PURPOSEOF THE STUDY:

Demand Side Management (DSM) usually is part of the least cost option of providing reliable and efficient energy services and hence provides a cost effective substitute for power plants. The rationale for DSM can be justified when we weigh other load management or more precisely supply management alternatives from the perspective of the utility, customers and society.

DSM has been originally defined as the planning, implementation and monitoring of a set of programs and actions carried out by electric utilities to influence energy demand in order to modify electric load curves in a way which is advantageous to the utilities. Changes in load curves must decrease electric systems running costs - both production and delivery costs -, and also allow for deferring or even avoiding some investments in supply-side capacity expansion. Thus, DSM has been driven by strict economic reasons. Hence, in societal terms, this was a typical win-win situation, as consumers would also benefit from cheaper energy services, as overall efficiency would increase.

Objectives:

1. To be able to define demand-side management.
2. To assess the concepts and need for DSM.
3. To provide an overview of the different types of demand-side management measures and the benefits.
4. To understand the challenges facing the implementation of demand-side management programs.

Scope of research

This dissertation would include the assessment of basic concept of Demand Side Management (DSM) and the various reasons put forward for promoting or undertaking DSM, the objective of the DSM, problems, DSM methods, the need for DSM so that electricity demand could be reduced at consumer end through effectively control and manage loads from utility side, the benefits and challenges of DSM.

1.4 RESEARCH HYPOTHESES

As public concerns about climate change and air quality escalate, there is increasing political pressure to find ways to reduce the environmental impacts of energy use. One approach currently being pursued by policymakers involves increasing support for 00"demand-side management programs. Since 1970s utilities have been implementing DSM programs designed to reduce residential and commercial electricity demand through information dissemination programs, subsidies, free installation of more efficient technologies and other conservation related activities. The program evaluations routinely find that these utility-sponsored DSM programs are highly cost effective DSM programs have the potential to play an important role in mitigating the environmental impacts associated with meeting the increasing demand for electricity end-uses. Past program evaluations and utility reported data have indicated that these programs are highly cost effective. In a study done by Loughran and Kulick (2004), they find that DSM expenditures during the 1990s succeeded in increasing the electricity efficiency of the U.S. economy.

While estimating energy savings from DSM programs, we want to know how the level of electricity consumption we observe after implementing a DSM program differs from what electricity consumption would have been in the absence of the DSM program.

Utilities who spend more on DSM programs report significantly larger percentage savings on average An un weighted average of reported savings weights smaller utilities with small DSM program expenditures and large utilities with significant program expenditures equally. It is worth noting that that there may exist economies of scale in implementing DSM. This is important since it implies that DSM (or at least the energy efficiency component of DSM) could be effectively administered the state level rather than by individual utilities.

Several types of DSM programs may be adopted by the utilities, some of which are stated below:-

- Rate impacts on usage can be estimated using price elasticity. Price elasticity measures either the reduction in use due to a price increase (own-price elasticity) or a shift in usage from peak to offpeak usage, due to different prices at different periods (cross-price elasticity).
- The dynamic pricing options of Critical Peak Pricing (CPP) and Real-Time Pricing (RTP) are assumed to be offered only after Advanced Metering Infrastructure (AMI) has been deployed. Thismeasure of real-time pricing, and critical-peak pricing acts as a guide to deployment of advanced metering infrastructure (AMI) technologies.
- Irrigation programs that allow direct control on irrigation pumps during periods of high demand.

- Nonresidential Load Curtailment programs that target larger commercial and industrial customers with shiftable loads and/or on-site standby generation assets that can be called upon by the utility, as needed.

These customers, entering into curtailment agreements with the utility shall receive financial incentives for their participation and willingness to provide resources when needed.

More than 30 countries globally have adopted DSM measures to overcome the obstacles standing in the way of rational energy utilization. Specific DSM applications differ in each country depending on the Program drivers and the local conditions.

In India, the DSM industry is still a nascent stage. Most of the projects implemented by the distribution utilities are at pilot level trying to establish a market and reduce the uncertainty in energy savings.

CHAPTER 2 : LITERATURE REVIEW

DSM has been recognized as an ally to environment conservation as it leads normally to lower overall consumption growth and contributes to using available resources in a more rational way. Huge savings, both financial, energy and environmental have been claimed, namely in the USA, as due to the massive adoption of DSM programs by utilities, bounded by strict regulatory constraints.

DSM programs and policies can be promoted and implemented at differentlevels of society, such as:

- Government policies and regulations;
- Utilities programs;
- Energy consumer participation.

Each of these categories has its own significant role to play. But the optimum results can be obtained by coordinating all three. Government agencies can make various policies and regulations, and provide subsidies for these programs. Utilities can implement these effectively through various programs, preferably with customized programs developed and operated in coordination with theend-users i.e. the energy consumers. Energy management has generally been accepted as an effective tool for reducing operational costs in industry and commerce, and the utilities have come to accept the concept as a "win-win" measure, both for the consumer and the utilities.

2.1 REVIEW AREA BROAD

The utilities have a significant role in helping their customers reduce energy consumption. The starting point of any analysis has to be an assessment of the effect on the demand for electricity of an active conservation policy. In first instance therefore we have to be able to assess the position with respect to the efficiency of energy use and electricity use in the absence of an active conservation policy. Such an estimate can then form the benchmark from which the effects of an active policy can be estimated.

In most cases, forecasts of electricity demand are used for planning purposes. The ability to estimate the effect on demand of an active conservation policy will depend on the extent to which the components of the base or benchmark forecasts are affected by the policies.

This is the reflection of the general approach which has to be adopted in the demand forecasting and involves a high degree of disaggregation. The following table illustrates the component parts of the three different sectors for the electricity demand forecast-

Domestic Sector-

Space Heating
Water Heating
Cooking

Appliances-

Refrigeration
Washing Machines
Tumble Dryers
Dishwashers
Irons
Vacuum Cleaners
Kettles
Television
Lighting
Others

Industrial Sector-

Industries Usages

Paper & Board

Printing & Publishing

Iron & Steel Process Heat

Chemicals Motive Power

Engineering Electro Chemical

Processes

Non-Ferrous Metals Space & Water

Heating

Textiles, Leather & Clothing Other

Food, Drink & Tobacco

Mineral Products

Energy Industries

Other Industries including

Construction

Commercial Sector-

Categories Usages

Shops Space Heating

Offices Water Heating

Education Inside Lighting

Hotels Outside Lighting

Transport &Catering

Communications Air Conditioning

National & Local Miscellaneous

Appliances

Government

Health

Other Premises

Table 2.1

Demand for electricity and for other fuels is assessed for each of the components parts of the forecast. So for example, we will have an assessment, for a given economic and fuel price background, for the amount of electricity used for motive power in the chemicals industry or for the amount of gas used space heating in shops.

For each of these components, therefore, there will be an assessment of efficiency with which electricity and other forms of energy are used. The sources of these assessments are varied and rely both on assessments of current and future technology and the extent to which 'best practice' will be implemented. In addition, for many uses, particularly for space heating, account has to be taken of current and future state and type of the stock of buildings in which the equipment will be operating.

Clearly there are a very large no. of judgments which have to be made and many if not at all of them have to be made on the basis of a limited amount of information concerning current practices and future trends. While such forecasting approach is intensive both in terms of amount of time and effort to produce it and in terms of its data requirements, it has particular advantages for example, the ability to show precisely how the overall level of demand is built up and to expose detailed estimates.

In summary, therefore, it is going to be very difficult to assess the effect on demand of an active conservation policy. Careful planning and research by individual utilities are needed to develop and implement cost-effective programs. It is particularly important to distinguish between the amounts of market-generated conservation that would occur independent of utility programs and the incremental amount attainable through such programs. Without this distinction, the amount of conservation attributable to utility efforts is almost certain to be overestimated, and its costs underestimated.

Therefore it is important to consider the very real problems in assessing the effect of an active conservation policy. In order to undertake an economic assessment, it is necessary to cost such policies. This is consequent upon the problems set out above that there will be considerable difficulty in quantifying the link between expenditure by the utility on promoting energy efficiency and the reduction in the demand resulting from it.

There are a number of other barriers also like inadequate permitted tariffs, less competitive energy cost in market and lack of information and communication technology & infrastructure etc. . The appropriate policies to overcome these barriers and to develop the sustainable energy efficient environment should also be reviewed.

2.2 REVIEW AREA NARROW

Demand side management (DSM) frames different concepts with the objective of enhancing the efficiency across the whole energy productive cycle. In DSM three concepts can be clearly identified: energy efficiency (EE), energy conservation (EC) and demand response (DR). Although they have some particularities, these are complementary concepts and in some cases, not well design DSM programs, may enter in conflict between each other.

The involvement and accomplishment of those programs improves their effectiveness and bring benefits for all the actors involved in the energy scenario within a liberalized market.

Compared with electricity supply options, DSM is disadvantaged by several market barriers – conditions which limit customer uptake of DSM measures or which reduce the incentive for electrical utilities to invest in DSM programs.

Barriers affecting customer uptake include lack of information and knowledge about energy efficiency, and financial considerations such as affordability, competing investment priorities, or access to financing. Together these barriers lead to real or perceived "transaction costs" that discourage investment even when it is cost effective to do so.

Barriers preventing electrical utilities from undertaking DSM programs include lack of sufficient financial incentive because of deregulation and restructuring, hidden subsidies for other options, and lack of expertise and infrastructure to deliver DSM programs.

These barriers can be removed through appropriate government policy and regulation, and by careful design of DSM programs.

2.3 FACTORS CRITICAL TO SUCCESS OF STUDY

Demand is largely uncontrollable and varies with time of day and season (there have be0en insufficient incentives for demand to become responsive). A key feature of demand is the diversity in usage of appliances. This is fully exploited in both electricity system design and operation. The capacity of an electricity system supplying several thousand households would be only about 10% of the total capacity that would be required if each individual household were to be self-sufficient (i.e. provide its own generation capacity). Distribution electricity networks are essential for achieving this significant benefit of load diversity. However, no material gains in the capacity of the electricity supply system would be made from increasing further the number of the households.

It is important to stress that the application of DSM techniques tends to disturb the natural diversity of loads and create some undesirable effects.Regular use of load control requires the ability of controlled devices (appliances) to reschedule operation (production) or the ability to continue operating during the interruptions by drawing on some form of storage. This storage can take the form of thermal, chemical or mechanical energy or intermediate products. DSM therefore redistributes the load but does not necessarily reduce the total energy consumed by the device (appliance).

Historically, the prospect of increasing the efficiency of system operation and the existing investment in the generation and transport of electricity has been the key driver for introducing DSM programs.Furthermore, commitment to market-based operation and deregulation of the electricity industry places consumers of electricity in the center of the decision-making process regarding the operation and future development of the system. Clearly, development of DSM will support this general trend and provide choice to consumers regarding usage of electricity and preventing cross-subsidies among consumers. However, DSM has not yet been fully integrated into the operation of electricity markets.

In addition, there are a number of other drivers that may accelerate the penetration of DSM, including the climate change challenge, development in information and communication technology (ICT) and the ageing assets of the electricity infrastructure.

DSM should provide choice to consumers regarding the usage of electricity and prevent cross-subsidies among consumers. The ability to respond to fluctuations in electricity prices can also be an important risk management tool. There have recently been some major advances made in information and communication technology or ICT, which in principle could enable the deployment of various DSM options

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It is expected that a significant proportion of the assets like the generation, transmission and distribution systems need to be replaced. This opens up the question of the strategy for infrastructure replacement, in particular the design and investment in future electricity networks and the role that enabling technologies, such as DSM, will have in designing future electricity systems.

2.4 SUMMARY

The main objectives for DSM programs are to achieve all prudent, cost-effective energy efficiency savings and provide an optimal amount of demand reduction from its demand response programs as determined through the Integrated Resource Plan (IRP) planning process.

A cost-effective monitoring system can provide detailed information for planning and assessing demand-side management (DSM) programs. Thus there is a need to describe methods, applications, and specific steps for developing such a system. Background DSM programs are receiving increased interest as alternatives to supply-side management options. As a result, accurate measurement and evaluation of program impacts have become critical steps--perhaps the most important in the DSM process.

Program implementation is often a challenging step in the demand-side management (DSM) process. It requires both a clear understanding of customer needs and the coordinated efforts of various departments within the utility. While load management can be implemented by customers without any interaction by the utility, usually the term Demand Side Management (DSM) refers to actions taken on the customer's premises that are actively encouraged or carried out by the utility.

DSM strives to improve the efficiency of energy use without any reduction in the services that the energy provides. However implementation of DSM programs has a number of practical obstacles but can be easily implemented by considering following points:

- As government is main driving force, hence promotion of DSM depends on the effective policies and decision taken by it.
- Awareness and motivate the market is another main key to promote the DSM.
- Government should provide direct subsidies on energy efficient appliances.
- Utility companies provide direct and indirect to consumer utilizing non-conventional energy sources.
- Arrange the funds for research and experimental work.

DSM optimizes the consumption manners and improves the terminal power consumption efficiency; it can not only fulfill the same power consumption function but also decrease the energy demand. DSM is a strategy to save energy, reduce consumption and environment improvement. DSM is an important tool for enabling a more efficient use of available energy resources. DSM applied to electricity systems can mitigate electrical system emergencies, minimize blackouts and increase system reliability, reduce dependency on expensive imports, reduce energy prices, provide relief to the power grid and generating plants, reduce investments in generation, transmission and distribution networks and contribute to lower environmental emissions.

CHAPTER 3: THE NEED FOR DSM

3.1 WHY PROMOTE DSM

Various reasons are put forward for promoting or undertaking DSM. For example, DSM may be aimed at addressing the following issues:

- Cost reduction—many DSM and energy efficiency efforts have been introduced in the context of integrated resource planning and aimed at reducing total costs of meeting energy demand;
- Environmental and social improvement—energy efficiency and DSM may be pursued to achieve environmental and/or social goals by reducing energy use, leading to reduced greenhouse gas emissions;
- Reliability and network issues—ameliorating and/or averting problems in the electricity network through reducing demand in ways which maintain system reliability in the immediate term and over the longer term defer the need for0network augmentation;
- Improved markets—short-term responses to electricity market conditions ("demand response"), particularly by reducing load during periods of high market prices caused by reduced generation or network capacity.

An energy customer may have many reasons for selecting a certain DSM activity. Generally these would be economic, environmental, marketing or regulatory. The above points are expressed in a slightly different way, where it is argued that the benefits of DSM to consumers, enterprises, utilities and society can be realized through:

- Reductions in customer energy bills;
- Reductions in the need for new power plant, transmission and distribution networks;
- Stimulation of economic development;
- Creation of long-term jobs due to new innovations and technologies;
- Increases in the competitiveness of local enterprises;
- Reduction in air pollution;

- Reduced dependency on foreign energy sources;
- Reductions in peak power prices for electricity.

An additional aspect is that of enhanced energy security through a diminished dependency on foreign energy sources. While the vulnerability to the volatility of international energy markets may not be the concern of an individual utility, industry or commercial company, at the national level, decreased dependency on energy imports can have important security of energy supply implications. For example, the dependency of many countries on oil, which as a primary resource is concentrated in only a relatively few countries, is creating geo-political tensions. In a survey conducted by the International Energy Agency (IEA) between government sand utilities of 14 OECD countries1 (INDEEP Analysis Report, 2004), the top four reasons given for implementing DSM programme were:

- Wanting reductions in global warming-related emissions of GHGs (environmental);
- Public image (marketing);
- Quality of service (marketing);
- Regulatory incentives (regulatory).

Where economic reasons were quoted for program implementation—such as reducing cost of services—actual implementations were relatively few. However, this survey focused on the motivation of government and utilities; industrial plants, commercial companies and individuals are likely to have different priorities.

3.2 WHAT DRIVES DSM?

The motivation behind the implementation of DSM is obviously different for the various parties involved. Thus for utility companies, the reduction or shift of a customer's energy demand could mean avoiding or delaying building additional generating capacity. In some situations, this would avoid or defer energy price increases that would otherwise be imposed on customers to help finance new investments in system capacity. For customers, DSM offers the opportunity to reduce their energy bill through efficiency and conservation measures. In the case of industrial customers, this would translate to lower production costs and a more competitive product. For domestic customers it means that they would save money that could be spent on other household commodities. Utilities (and thus governments, where utilities are nationalized enterprises) can therefore be one of the key driving forces behind DSM implementation but energy customers should also be motivated in using energy more efficiently, subsequently reducing their energy demand and thus their energy costs. Consumers may also be able to take advantage of any special incentives offered by utility companies, and may participate in programmes offered by the utilities (and possibly supported by government).

Organizations with energy-dependent activities such as industrial manufacturers and owners/operators of buildings are often strongly interested in DSM, primarily to reduce their own energy consumption and costs, and partly perhaps to assist their local utility to maintain a reliable energy supply. The latter is of course directly in the interests of the energy user.

Industrial plants are often able to reduce overall demand by adopting various kinds of energy efficiency measures. Depending on the processes used, many have the flexibility to reschedule their periods of highest demand to cut peak loads and to even out their demand over a longer or different time period, thus helping the utility itself to run at higher efficiency.

The investment needed for these actions may be quite low if a simple retiming of operations proves possible. Other measures, such as replacing electric motors with high efficiency versions or installing variable speed drives, will require investments. A financial evaluation of any proposed measure is needed to see where and when the benefits of DSM can be accrued to the industrial enterprise. Provided a reasonable return on investment can be assured, the enterprise management should take prompt action, in some cases with the technical advice of the utility company experts.

For building owners or operators, there may be a variety of cost effective measures available. For example, light fixtures can be modified and heating and cooling systems can be altered from constant-volume to variable-volume drive applications (or indeed replaced entirely by new equipment). Equipment changes and new controls and other instruments, e.g. meters or timers, should also be considered.

In conclusion, based on the discussion above on "Why promote DSM?" and taking into account the driving forces for DSM, it is possible to trace the rationale of the various DMS efforts back to two main categories:

- Cost reduction and environmental motives;
- Reliability and network motives.

3.3 COST REDUCTION AND ENVIRONMENTAL MOTIVES

DSM was started with the focus strongly on electricity systems. There was a first wave of DSM activity in California in the late 1970s as part of the response to rising oil prices (cost motivation) and increasing public hostility to new power stations (environmental motivation). However, the initiative began to develop in earnest in the United States in the early 1980s, in the context of integrated resource planning where the emphasis was on reducing total costs (financial and environmental) of meeting energy demand.

California set up the California Energy Commission (CEC) which worked with the California Public Utilities Commission (CPUC) to set spending targets for energy conservation and load management for the state's four investor-owned utilities. During the 1980s and early 1990s, cost reduction and environmentally-driven DSM programs were implemented in many United States, Canada and a number of European countries. Essentially, DSM was made attractive for utilities, through changes to the incentives set by regulators.

Before these changes were made, the utilities would lose income if they sold fewer kWh and DSM programmes offered risk but no reward for shareholders, as such investment would not be added to the asset base on which the regulators calculated the allowed rate of return. The solution was to make utility profits less dependent upon the numbers of units sold and to enable the utilities to earn profits on DSM activities. DSM became a major activity in the United States with utilities spending $US 2.8 billion on it by 1993. The main activity undertaken under DSM program was energy efficiency for customers. Typically, utilities would subsidize the cost of energy saving measures such as efficient heating systems, appliances, lighting and insulation.

DSM as operated in the 1980s and early 1990s worked in the context of vertically integrated monopoly electricity utilities. It is more complicated to use it where companies are not vertically integrated and/or where competition has been introduced. As electricity market reform was introduced in the United States from the mid-1990s, spending on DSM fell by 50 per cent from 1994 to 1997. Nevertheless it is possible to use it where electricity reforms have taken place, particularly in the natural monopoly distribution side where network-driven DSM can be particularly useful.

The fate of DSM programs in the face of power sector reform has varied widely across the globe. In some jurisdictions, DSM programs are now coordinated by governmental or other agencies, rather than utilities, and funded with taxes or general revenues, rather than by ratepayers. However, in most countries where DSM is used it is funded through electricity bills and the electric utilities are actively involved in program design and delivery. Policies that support the continuation of DSM programs include the following, often in combination:

- An agreed-upon or mandated quantified target for energy savings;
- A funding mechanism that strengthens, or does not harm, the competitive position of the energy companies practicing DSM;
- A standardized and mandatory scheme for cost-benefit evaluation of the DSM activities;
- Price regulation of the remaining monopoly segments (transmission and distribution network and retail supply to non-eligible customers) in a manner that removes artificial incentives to increase sales and disincentives to save energy(e.g. Denmark, Italy, NSW in Australia, Norway and the United Kingdom).

The implementation of different DSM mechanisms would incur different costs that need to be carried by government, utilities or consumers. Often any implementation cost is passed on to the consumer, for example, by the utility in the form of higher tariffs or by the manufacturer of an energy efficient appliance in the price tag of that appliance. However, government in the form of subsidies or loan assistance may often share these costs.

The advent of competitive electricity wholesale (generation) markets in which prices can be highly volatile is encouraging the development of market-driven DSM, particularly to provide short-term responses to energy market condition ("demand response"). Market-driven DSM is a growth area in the United States and this is likely to be replicated in other developed countries that have competitive electricity markets. Such market-driven DSM will be primarily motivated to achieve cost savings. It may also reduce energy demand although it may mainly shift demand to times when prices are lower. Market-driven DSM may have positive or negative environmental impacts. This will depend upon the nature of the marginal generating plants that may be displaced (e.g. coal or gas) and the demand-side response (e.g. energy efficiency measures or different forms of distributed generation such as solar or diesel).

A study conducted by the Government of New Zealand estimated in about 22 per cent of current consumption, the economically efficient savings that New Zealand could achieve through electricity DSM over a five-year period. More realistic estimates have set between 6.5 per cent and 11 per cent the amount of savings that could be practically achieved.

DSM effectiveness needs to be quantified and this can be achieved using measurement and verification (M&V). M&V has the advantage of being an impartial, credible and transparent process that can be used to quantify and assess the impacts and sustainability of DSM and energy efficiency projects. It provides customers and utilities with information on the impact of the DSM program so that future planning can take into account the results.

Whilst there will be environmental benefits from not constructing new infrastructure, these need to be considered alongside actions taken to avoid infrastructure development. Most (e.g. energy efficiency, distributed co-generation using gas, solar power) will bring environmental benefits but some (e.g. some forms of stand-by generators) may create some environmental problems such as localized noise and pollution from diesel generators and risk of pollution from careless disposal of batteries or other equipment.

3.4 RELIABILITY AND NETWORK MOTIVES

Network constraints are becoming a problem in both developed and developing countries where electricity demand is increasing and network infrastructure is becoming inadequate. For example, air conditioning is a major growth area in many countries. In many situations, network-driven DSM can delay the need for network expansion and augmentation. Sometimes network-driven DSM may even be able to eliminate cost-effectively the requirement to build a large-scale distribution network: this may be particularly useful in many developing countries where extensive distribution networks do not exist. Although experience to date with this type of DSM is limited, network-driven DSM may offer the scope for significant savings in costs in the future.

CHAPTER 4 : PLANNING & IMPLEMENTATION

4.1 APPROACH

There are many different programme approaches that can be used to implement DSM Program including:

1. General information programmes to inform customers about generic energy efficiency options.
2. Site-specific information programs that provide information about specific DSM measures appropriate for a particular enterprise or home.
3. Financing programmes to assist customers with paying for DSM measures, including loan, rebate, and shared-savings programmes.
4. Direct installation programmes that provide complete services to design, finance, and install a package of efficiency measures.
5. Alternative rate programmes including time-of-use rates, and load shifting rates. These programmes generally do not save energy, but they can be effective ways to shift loads to off-peak periods.
6. Bidding programmes in which a utility solicits bids from customers and energy service companies to promote energy savings in the utility's service area.
7. Market transformation programmes that seek to change the market for a particular technology or service so that the efficient technology is in widespread use without continued utility intervention.

The process to plan and implement DSM programs generally consists of the steps defined in Figure 1. These steps are not cast in stone; the actual process is dynamic and varies according to the specific needs of each utility.

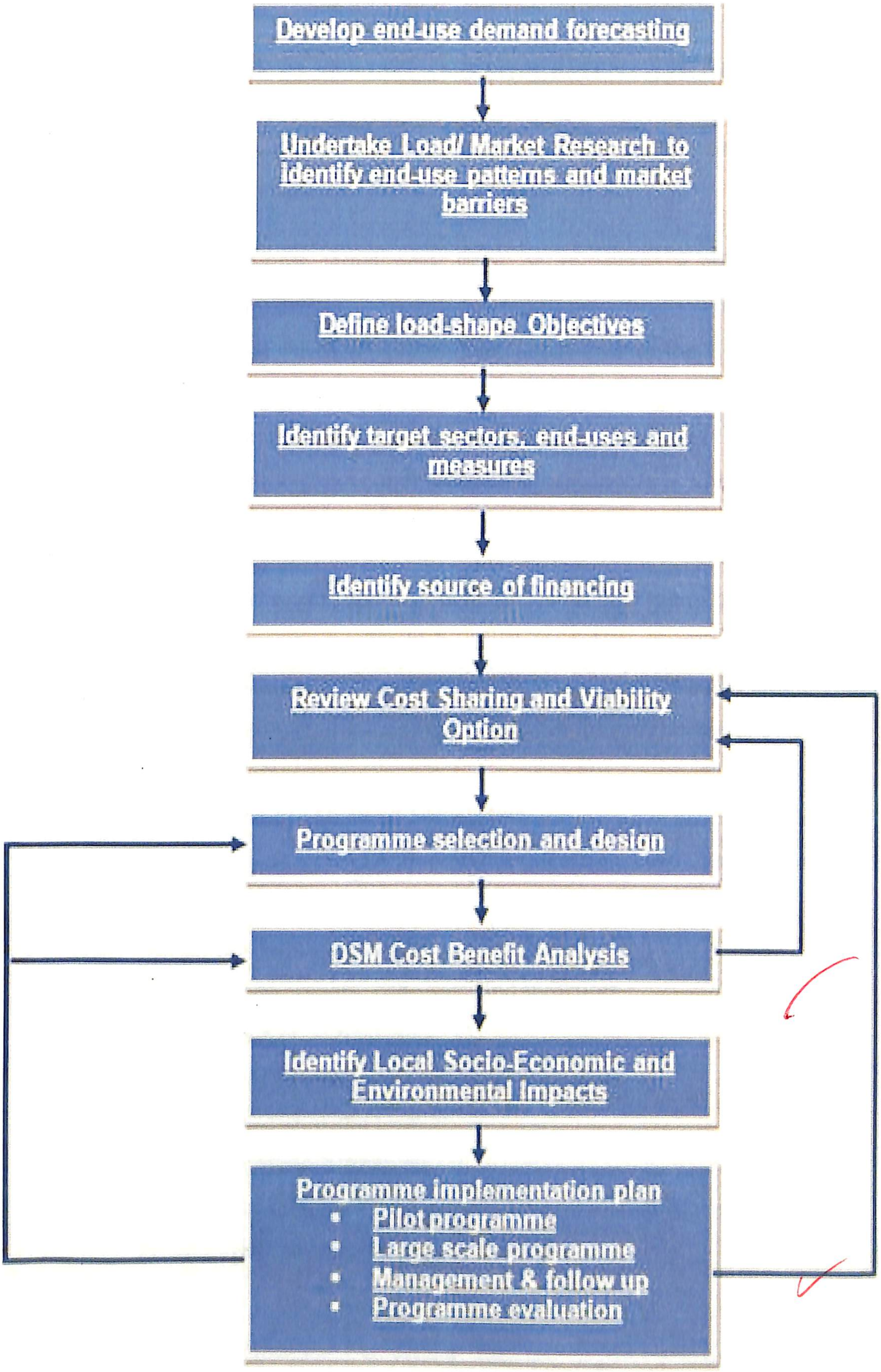


Figure 4.1: Demand Side Management Planning Procedure

4.2 DSM PROGRAMME PLANNING AND IMPLEMENTATION

This chapter sets out the steps in DSM Programme Planning and Implementation. The first step in DSM programme design is to decide on its goal:

- Should the programme target peak loads or encourage a general reduction in electricity consumption?
- Is a "market transformation" programme needed or is the objective to reduce demand in a particular sector or area?
- Should the programme target existing stock or new equipment?
- Are the targeted participants communities and consumers in low income situations or those which can more easily afford to participate?

The answer to each of these questions will help decide on the type of programme to use. The length of the programme should be long enough to ensure complete market transformation or to achieve other programme goals. It should also be long enough to ensure that improvements in efficiency continue after the programme is over.

1. Develop end-use Demand Forecasting
2. Undertake Load/ Market Research to identify end-use patterns and market barriers
3. Define load-shape objectives
4. Identify target sectors, end-uses , and measures
5. Identify sources of financing
6. Review Cost Sharing and Viability Options
7. Program Selection and Design
8. DSM Cost/ Benefit Analysis
9. Identify Local Socio-Economic and Environmental Impacts
10. Program Implementation Plan

1.Develop end-use Demand forecasting

Forecasting by end-use is an essential pre-requisite for effective DSM planning and implementation. Mid- and long-term forecasts of power demand variations play a very important role in the development of a DSM programme. However, this exercise is not generally an integral part of the DSM planning process. In fact, demand forecasting is an exercise that every electricity-generating company should carry out regularly in order to assess its future equipment requirements. However, if these forecasts are not available, they must be prepared at the beginning of the DSM programme planning activity since load-curve modification objectives must be based on them. It is important to note that electricity companies often plan and implement DSM programmes after a demand-forecasting exercise. It is especially important in economies where per capita consumption is low and growth rates in electricity demand are high, so that macro-economic and technical parameters can be treated separately.

Estimates of current electricity consumption and peak demand should be disaggregated by sector and end-use – motive power, lighting, cooking, etc., and load curves derived for each sector and end-use.

2. **Undertake Load/ Market Research to identify end-use patterns and market barriers**

To design effective DSM programmes it is important to know how electricity is used and what barriers are preventing customers from using efficient technologies.

Load research should be undertaken to estimate load curves for each sector or region, using local sub-metering, customer bill analysis and customer surveys. Major areas of interest to DSM programmes include the residential, commercial, industrial, and public utility sectors.

Market research is needed to understand the target market, identify barriers and evaluate possible solutions. This research can be carried out through customer surveys which can be used to determine current equipment usage, decision making criteria, and views on different types of programmes. It is also important to carry out a survey of local suppliers to assess the availability of efficient products and services.

3. **Define load-shape objectives**

Based on the results of the load research in the utility, load shape objectives need to be selected for the current situation. There are six main objectives(which will be discussed in detail in the following chapter) defined in context of DSM, known as peak clipping, valley filling ,Load shifting ,Strategic conservation ,Strategic load growth and Flexible load shape.

I. Peak clipping refers to the reduction of system peak loads. It is generally considered as the reduction as the reduction of the utility demand by the means of direct load control primarily during the peak demand.

II. Valley filling (increased demand at off peak) involves increasing the load during off-peak hours. Valley filling consists of building off-peak loads.

III. Load shifting (demand shifting to non-peak hours) involves shifting peak loads to off-peak hours

IV. Strategic conservation (the reduction of utility load, more or less equally, during all or most hours of the day) is one of the non-traditional approaches to load management and results from utility-stimulated conservation.

V. Strategic load growth (increase of utility loads) is the load-shape change which refers to the overall increase in the consumption of electricity at the consumers' end.

VI. Flexible load shape refers to programs that allow utility to alter customer energy consumption on an as-needed basis, as in interruptible/curtailable agreements

These six forms are not mutually exclusive and may frequently be employed in combinations. The purpose of first three traditional forms of load management is to level curve of general electricity demands.

4. **Identify target sectors, end-uses, and measures**

At this stage in the planning process, the collected information is normally useful in determining a typical load curve for each end-use. Analyzing how electrical power is used will then lead to identification of the services where activities should be launched in order to meet load-curve management objectives through DSM programme. It is important to target DSM programmes where they can make the largest impact.

- Choose sectors and end-uses that account for the largest power consumption and peak loads, or will do so in the future.
- Select DSM measures which will have the largest impact on peak demand and electricity use.
- Target localities, sectors, end uses and measures where DSM programmes are most likely to make a difference or have the highest benefit to utilities – e.g. where losses are high, or tariffs are below the cost of new supply.

5. **Identify sources of financing**

In any DSM programme, financing is needed for individual projects undertaken by participants. Utilities may also require financing to cover administrative costs and cost sharing investments.

The types of innovative financing that can be used to encourage participants to undertake projects under a DSM programme include:

- Direct contracting by the utility
- Performance contracting by the utility
- Performance contracting by Energy Service Companies (ESCOs)
- Leasing
- Participant self-financed savings re-investment

Major sources of project financing can include:

- Energy Service Companies
- Revolving funds (from a Lines or Public Benefit Charge)
- Self-financing – recovery of costs through tariffs
- Private equity, venture capital funds and project finance debt from nationalized Banks/Private Banks.
- Dedicated lines of credit or Special funds generated from the levy of additional charges to the end-users.
- Multilateral, bilateral and other international institutions/development agencies dedicated to promoting energy efficiency services.

Regulators can play an active role in arranging the funds for utilities to implement DSM initiatives. Also the utilities have to adopt sound marketing strategies to attract private equity and other project finance loans from nationalized banks.

6.**Review Cost Sharing and Viability Options**

Cost sharing in a DSM programme should try to maximize viability for each partner (participant, utility, and government). If current tariffs are below the marginal cost of new power supply options, it is financially viable for the utility to share in the cost of the efficient technology and maximize participation in the programme. The wider the differences between tariffs, the higher the utility investment can be, which in turn leads to a higher participation rate. If the full environmental cost of power supply is higher than the average cost then governments can also share in the cost of the programme, by contributing to administration costs, requiring favourable treatment of DSM through the tax system, or providing financial support directly to users.

7. **programme Selection and Design**

In this step, the planner packages the measures identified in Step 4 into logical groups for programme delivery. The planners target customer and end-use market segment, avoided cost value, and the sponsoring utility management and customer service approaches in identifying a list of programmes for each customer class. In order to ensure consistent programme design, the planner should use a uniform reporting format to specify each programme.

8. **DSM Cost/Benefit Analysis**

The information used to assess the measures and design of the programmes will be used to evaluate the financial interest in DSM programme. The benefits and costs of a DSM programme will be different for each partner involved in the programme - the energy user (participant), the agency or power utility running the programme, and society at large as represented by a strategic planner or government.

Benefits

The direct benefits of a DSM programme are the energy savings achieved (e.g. kWh/yr) and the peak demand reduction. The value of these savings to an energy user depends on the energy tariff (electricity price and demand charges). There are also possible maintenance or labour saving benefits associated with the efficient technology.

The value of these same savings to the power utility and to society at large depend on the "avoided" or long run marginal cost of new energy supply (e.g. a power plant and/or transmission line). This avoided cost is the energy cost for the next kW of capacity added to the system. The avoided cost depends on whether the savings are at peak or off peak times (as measured by the coincidence factor), and whether there is current excess capacity.
All parties benefit if energy costs escalate in real terms over time.

Costs

There are three basic cost components in a DSM programme:
1. Technology Costs - The incremental cost of the efficient technology
2. Transaction Costs - The administrative and other costs of running the programme
3. Financing Costs - The cost of financing the energy efficient technology

Again, different costs are borne by each partner. A power user pays the incremental cost of the technology, plus the cost of financing, minus any contribution that the programme agency makes through financial support. This contribution may be in the form of a soft loan, support to the supplier to lower the price, or direct payment to the user.

The costs to the utility include the programme administrative costs and the contribution to the user towards the cost of the technology. Lost revenue must also be taken into account.

The overall cost to society, however, - the cost to be used in strategic planning - is simply the technology plus programme administrative costs. This is often called the Total Resource Cost. The sharing of the technology cost between the user and the programme agency does not affect the total cost, and financing charges are not normally considered in strategic planning.

Each DSM programme should be evaluated as to its viability from different perspectives – society, utility, consumer, and contractor (if used in the programme). Using estimates of the up front and annual costs and benefits for each partner, internal rates of return and net present value can be calculated. These measures allow a DSM programme to be compared both with power supply options and with other investment options. The cost of saved energy (CSE cost/kWh) and peak demand reduction(CDR cost/kW) , are also useful measures to compare DSM to supply options.

Economic Analysis

Economic costs include the incremental cost of the new efficient technology, any annual increases in operating costs, and the cost of the DSM programme administration. Cost sharing arrangements do not affect economic costs. Economic benefits include reductions in maintenance or operating costs, and the value of the savings achieved through the programme. This is normally the kWh saved times the long run marginal cost of power, the willingness to pay of customers with the highest tariffs, or the cost of power from independent power producers – plus any premium added to allow for environmental or social costs.

Financial Analysis

The costs and benefits used to estimate financial returns vary among partners and depend on additional programme characteristics such as cost sharing arrangements and lost revenue. Tax and other measures also affect financial returns. The costs and benefits for each partner are shown in the table below.

It is important to carry out rigorous sensitivity analysis to determine the "switching values" of important parameters such as participation rates, savings expected from each project, technology costs, programme costs and valuation of savings.

9. **Identify Local Socio-Economic and Environmental Impacts**

Most DSM programmes provide indirect economic and environmental benefits as well as reducing emissions and other impacts from power supply facilities. For example, employment is created in the energy services industry and consumer savings are reinvested in other goods or services. These impacts can be estimated using "input/output" or other economic models. Indirect environmental impacts might include the benefits of accelerated removal of CFCs from air conditioners, or a plan to establish a disposal facility for used fluorescent lamps.

10.programme Implementation Plan

Implementation of any DSM programme requires a core DSM staff or "cell" within a power utility to develop a plan for the programme and manage its implementation, even if consultants are hired for both aspects of the programme.
A DSM implementation plan should have the following elements:

- Staffing plan and job descriptions for different aspects of the programme – contracting, marketing, supervision, monitoring and evaluation.
- Standard contracting procedures for direct installation, marketing, and standing offers or bidding procedures for energy service companies.
- A promotion/marketing plan to maximize participation.
- A schedule of activities with participation targets for each year of the programme.
- A budget and expenditure plan.

A monitoring/evaluation plan including verification protocols, templates for customer bill analysis, and participant surveys.

1. Review cost sharing and viability options
2. Select programme type and identify roles and responsibilities
3. Estimate participation rates and savings
4. Estimate costs and benefits
5. Conduct economic and financial evaluation/assessment of programme and typical projects
6. Identify local socio-economic and environmental impacts
7. Prepare programme implementation plan

CHAPTER 5 : TECHNOLOGIES USED IN DSM

5.1 Technologies used in DSM

The energy conservation technologies are implemented to reduce total energy use. Specific technologies include energy-efficient lighting, applications and building equipment.

5.1.1Load Levelling

These technologies are used to smooth out the peaks and dips in energy demand- by reducing consumption at peak times ("peak clipping"), increasing it during off-peak times("valley filling"), or shifting the load from peak to off-peak period- to maximize use of efficient base load generation and reduce the need for spinning reserves.

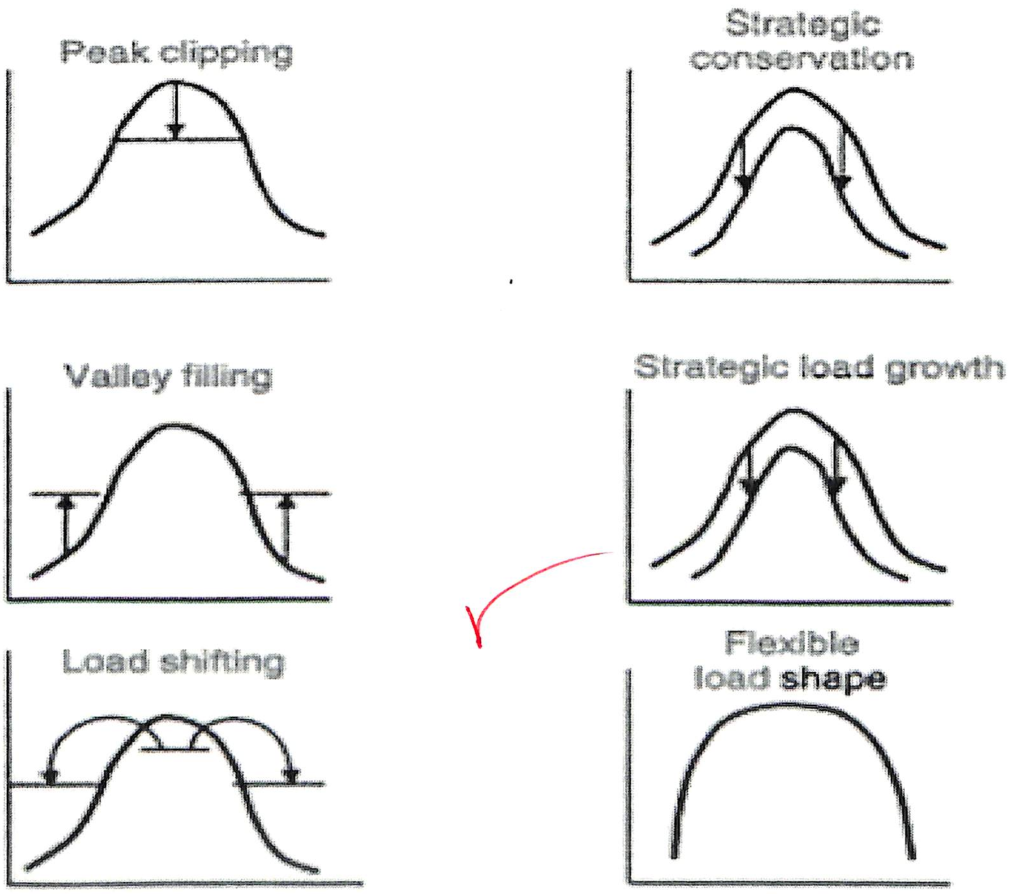


Figure 5.1 DSM Load Shape Curve (Demand in MW Versus Time)

Peak clipping, or the reduction of the system peak loads, embodies one of the classic forms of load management. Peak clipping is generally considered as the reduction of peak load by using direct load control. Direct load control is most commonly practiced by direct utility control of customer's appliances. While many utilities consider this as a means to reduce peaking capacity or capacity purchases and consider control only during the most probable days of system peak, direct load control can be used to reduce operating cost and dependence on critical fuels by economic dispatch. Another example of peak clipping is the use of interruptible/curtailable rates for industrial and commercial customers.

Valley filling is the second classic form of load management. Valley filling encompasses building off-peak loads. This may be particularly desirable for those times of the year where the long-run incremental cost is less than the average price of electricity. Adding properly priced off-peak load under those circumstance decreases the average cost to customers. Valley filling can be accomplished in several ways, one of the most popular of which is by adding new thermal energy storage (water heating and/or space heating) in place of loads served by fossil fuels (gas-or oil-fired).

Load shifting is the last classic form of load management. This involves shifting load from on-peak to off- peak periods. Popular applications include use of storage water heating, storage space heating, coolness storage and customer load shifts. In this case, the load shift from storage devices involves displacing what would have been conventional appliances served by electricity (e.g., installing thermal energy storage water heaters in place of regular electric water heaters).

Strategic conservation is the load-shape change that results from utility-stimulated programs directed at end-use consumption. The change reflects a modification of the load shape involving a reduction in sales often as well as a change in the pattern of use. In employing energy conservation, the utility planner must consider what conservation actions would occur naturally and then evaluate the cost effectiveness of possible intended utility programs to accelerate or stimulate those actions. Hence the distinction between "naturally" occurring and deliberately induced changes in energy consumption and load shape is important. Examples include weatherization and appliance efficiency improvement.

Strategic load growth is the load-shape change that refers to a general increase in sales, stimulated by the utility, beyond the valley filling described previously. Load growth may involve increased market share of loads that are or can be served by competing fuels, as well economic development in the service area. Examples include dual fuel heating, heat pumps, and promotional rates. In the future, load growth may include electrification. Electrification is the term currently being employed to describe the new emerging electric technologies surrounding electric vehicles, industrial process heating, and automation. These have a potential for increasing the electric energy intensity of the US industrial sector. This rise in intensity may be motivated by reduction in the use of fossil fuels and raw materials resulting in improved overall productivity.

Flexible load shape is a concept related to reliability, a planning constraint. Once the anticipated load shape, including demand-side activities, is forecast over the planning horizon, the power supply planner studies the final optimum supply-side options. Among the many criteria he uses is reliability. Load shape can be flexible if customers are presented with options as to the variations in quality of service that they are willing to allow in exchange for various incentives. The programs involved can be variations of interruptible or curtail able load, concepts of pooled, integrated energy management systems; or individual customer load control devices offering service constraints.

5.1.2Load Control

Energy management control system (EMCSs) can be used to switch electrical equipment on or off for load levelling purposes. Some EMCSs enable direct off-site control (by the utility) of user equipment. Typically applied to heating, cooling, ventilation, and lighting loads EMCSs can also be used to invoke on-site generators, thereby reducing peak demand for grid electricity. Energy storage devices located on the customer's side of the meter can be used to shift timing of energy consumption.

CHAPTER 6: MONITORING DSM BENEFITS

This chapter examines benefit evaluation for the life cycle of a DSM program, delineating the stages of the program in which the benefits can be evaluated or monitored, and examining conceptually the type of impacts that might be observed.

6.1. Phases of Monitoring

DSM initiatives can be grouped into four major phases: preprogram stage, developmental stage, full-scale program stage, and mature full-scale program stage (see Table 6_1).1 Figure 6-1 depicts the linkages among the different stages.

Stage	Activity	Objective
Preprogram	• field testing • simulation modeling	• Identify most promising initiatives for further review
Developmental	• pilot project • feasibility analysis • hour-to-hour monitoring of sample	• Evaluate performance of initiatives for full-scale operation
Full-Scale	• utility-wide programs • large expenditures	• Select initiatives compatible with least-cost planning goals
Mature Full-Scale	• opinion polling • billing analysis • cost sampling	• Evaluate performance of on-going programs relative to expectations

Table 6.1

ACTIVITIES/OBJECTIVES OF DIFFERENT STAGES FOR DSM INITIATIVES

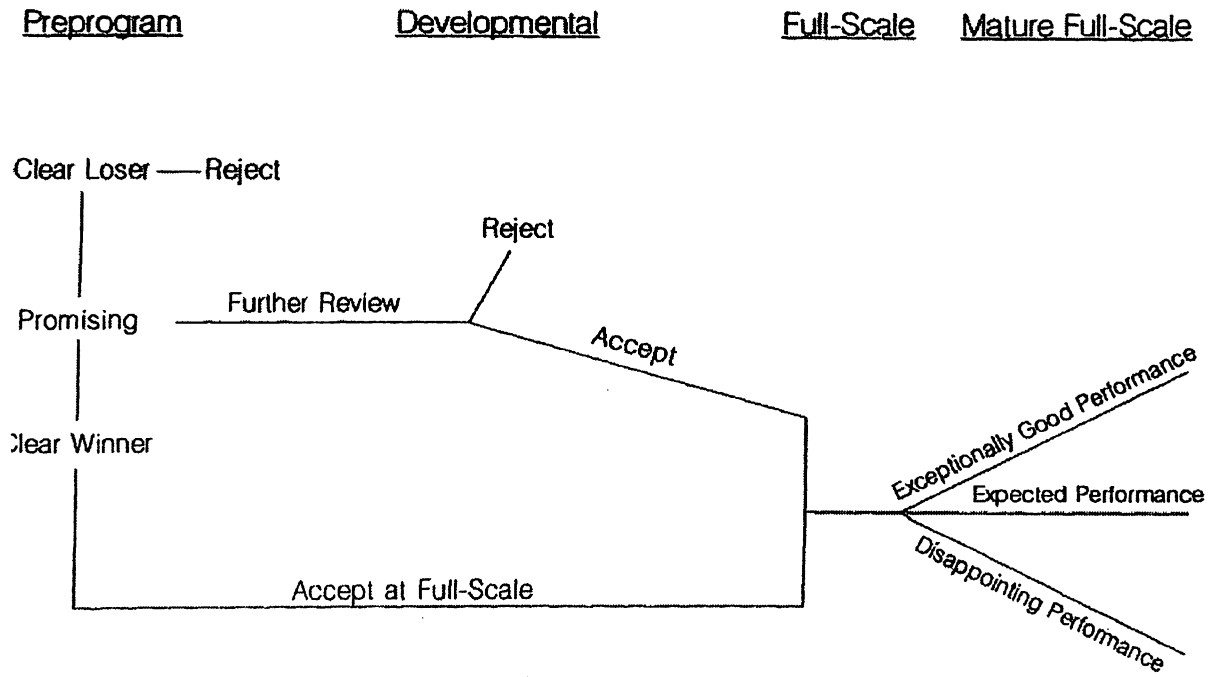


Fig 6.1 sequential steps in program evaluation

The preprogram stage involves undertaking a trial process to obtain some parameters in designing a development program. The preprogram stage may include small-scale field testing of different technologies-concepts and the building of mathematical models-computer programs or both. In this phase it is possible to meter or wire typical end-use equipment to determine their characteristics and responses under load control conditions.

In the developmental stage more extensive trials are undertaken to assess the behavior of a large group of customers subject to the program. Monitoring might include statistical, technical, and subjective techniques. For instance, all end-use consumption might be monitored on an hour-to-hour basis to assess the diversity of use, the effect of participation rates on load shape, and so on.

During this phase a feasibility analysis as well as preliminary costs and load-energy analyses are conducted. Based on the results, the expected benefits of a full-scale program are extrapolated. Assumptions include variables such as participation rates, diversity of consumption of the larger samples, as well as financial and economic parameters. The developmental stage results in a "go-or-no-go" decision on whether the utility should proceed to the next stage. A decision to embark on a full scale program requires favorable results from a cost-benefit analysis.

During the developmental stage, it is common to undertake pilot programs. A pilot program, or any DSM program for that matter, has two objectives: 1) accurately measure the effect of a DSM program on the participant group itself, and 2) generalize the pilot, or small-scale, results to a wider--or the entire--population. The success of a pilot program depends on applying the measured effects of the program to customers outside its scope. A poorly designed pilot program that yields bad information has little value either for a utility or a commission. A pilot program's chief purpose lies in minimizing the risk of a utility running a "bad" program or rejecting a "good" program, both on a large scale. Since a large-scale program can cost a utility and its ratepayers millions of dollars, obtaining valid and meaningful data for the outcomes of a pilot program reduces the chances of a utility and its commission adopting a "bad" program. Similarly, by rejecting a "good" program because of faulty data, a utility may expend large sums of money unnecessarily for power plant construction and operation.

Two primary objectives exist for examining and interpreting the data collected from a pilot program: 1) estimating the change in electricity consumption by participants that is directly attributable to the program, and 2) projecting the change in electricity consumption by participants outside the test area that would result from adopting a permanent program. The biggest obstacle lies in the fact that the true response to a program both by participants and nonparticipating customers is unobservable. For example, how participants would have behaved in the absence of a program cannot be observed. Nor can the response of customers outside the test site if the program were offered to them.

In the developmental stage of some DSM programs, the actual load shape (kilowatts saved) and the energy consumption (kilowatt hours saved) in test groups actually can be metered. In such cases, no ambiguity exists in the results of the test group. The focus, however, may be on projecting the savings by analytical means to the full-scale stage.

The full-scale stage of the program is characterized by a commitment to a substantial expenditure of money and a large-scale eligibility of participants. That the program will be cost effective is assumed based on the results of the previous stages. This is not certain, however. It is critical to monitor the impact at the full-scale stage to yield ultimate conclusions.

The mature full-scale-program stage is embarked upon when the cumulative experience with the program is ample. During this stage, the program's operations are optimized by proper monitoring techniques, which include cost sampling, load sampling, opinion polling, and so forth.

CHAPTER 7: INFORMATION DISSEMINATION ON DSM

Energy savings and energy efficiency improvement depend on the combined efforts of many individuals. Well-motivated personnel are best able to develop and implement energy efficiency policies that are crucial for continued energy efficiency improvement in their organizations. It is therefore necessary to raise awareness by campaigns informing the staff of energy-consuming organizations about energy efficiency options and specific DSM techniques (Lugano Wilson,2006).

These campaigns may be marketed by personal contact and visual media (such as posters, fliers, leaflets, brochures and video clips), as well as carrying out energy audits, which also have benefits with respect to energy awareness. An IEA survey (INDEEP Analysis Report, 2004) showed that most DSM programmes in industrialized countries used "personal contact" as the means of marketing. This was closely followed by "direct mail" or "advertising" and lagging a bit further behind was marketing by conducting "energy audits".

DSM promotion

DSM programmes and policies can be promoted and implemented at different levels of society, such as:

_ Government policies and regulations;

_ Utilities programmes;

_ Energy consumer participation.

Each of these categories has its own significant role to play. But the optimum results can be obtained by coordinating all three. Government agencies can make various policies and regulations, and provide subsidies for these programmes. Utilities can implement these effectively through various programmes, preferably with customized programmes developed and operated in coordination with the end-users i.e. the energy consumers.

CHAPTER 8 : TYPES OF DSM MEASURES AND PROGRAMS

Utility try to encourage energy users to alter their demand profile by shifting demand towards valley using various strategies. There are various opportunities and techniques available for reducing energy consumption and to reduce peak demand. Broadly DSM programs are:

- Financial Incentive/Plenty
- Load Scheduling
- Energy Conservation

A. Financial Incentive/Plenty Programs

In financial incentive DSM Program, Consumer's should charge at different tariff depending upon the energy use time . Utility companies should provide the inspiring prices to consumer's i.e. high unit rate during peak load time, average rate per unit during base load time and discounted rate per unit if consuming energy during low demand period. In addition to that also provide discounted rates at week end, holidays etc. Implement requirements of this program are discussed below:

- Units consumed during peak load should be charged highest rate, average rate per unit during base load period and discounted rate per unit during low demand period; hence it is required to distinguish between peak load, base load and low demand periods.
- However, some consumers are ready to pay high unit rate during peak load time but still not allowed to use energy more than predefined KW say as per their sanctioned maximum demand.
- Duration of time for which consumers used energy
- Sum up all units consumed during a fixed time say one month.
- As consumers are ultimately using energy, hence they should be able to easily understand the load period i.e. whether peak load, base or discounted load time

EFFECTIVENESS

Since consumers have opportunity to reduce their energy consumption bill without reducing the demand, so they voluntary participate to shift their load towards valley (disconnected time). During low valley periods consumers can also store the electricity by converting it into thermal power, chemical energy etc. Then utilize energy during peak demand period, while enjoying the discounted rates.

B. LOAD SCHEDULING PROGRAMS

Load on the power plant is variable in nature. There is large difference between peak demand and valley demand. However, the power plants are designed to meet the maximum demand, which results in high generation cost per unit and demand large installed capacity. It is not possible for developing countries to meet the targeted capacity by installing new power plants. Consider a power plant, having maximum demand of 2000 kW and average load of 1200 kW. Load factor which is the ratio of average demand to the maximum demand is 0.6. Load factor of a plant is less than unity. Lower the load factor higher the rate per generation as power plants are designed to meet the maximum demand. Higher the difference between peak demand and valley demand, resulting in the higher generating cost per unit and demand. In order to reduce the peak demand, here we use the load scheduling strategy , in which 400 KW load is considered as base load and allowed to supply for 24 hours and remaining 19200 KW load is scheduled into three groups. Each group is allowed to operate for 8 hours. The load scheduling settling time is implemented and utility has the direct control over the load.

EFFECTIVENESS

Power plant's maximum demand is reduced from 2000 KW to 1200 KW by load scheduling that can be used to meet future increasing demand requirement. Since now plant is operating at unity load factor, hence also low generation cost per unit.

C. ENERGY CONSERVATION PROGRAMS

Load scheduling methods help to reduce the peak demand by shifting the demand towards valley, without participating to reduce the total consumption. Therefore these methods are not the only solution to fight with this problem. Setting up of new generating plant for developing countries like India is not as easy because of lack of funds, available resources and it also requires more time for proper installation.

i. Lighting

Lighting is a significant component of energy demand in all sectors particularly at the time of peak demand. There are number of places where electricity is wasted in lighting, By taking little measure it is possible to reduce the wastage. The various places where opportunities are available to reduce the energy consumptions are: Institutes/ Colleges and Offices. It is also observed that at institute level, a huge amount of energy is wasted. So there is a need to ensure that the number of electrical appliances that are brought into campus is regulated and the automatic switching system and sensors should be installed in order to save electricity.

ii. Festive Seasons

It is also observed that a huge amount of energy is wasted in lighting during festival seasons, marriages and parties. So there is need to aware the people regarding electricity crisis and motivate them to use energy efficient lamps and encourage them to avoid the use of unnecessary decorative lights. One simple solution to this problem is promoting daytime marriages and parties rather than night.

iii. Street Lights

Everyone knows the importance and wastage of energy in street light. Street lighting is required from evening to morning and actual timing depends on season, but it is seen that these lights are not switched off many times, hence energy is wasted. In order to save energy, LDR circuits should be installed with these street lights that automatically switch off the lights when the sun rises. In addition to this, another problem with street lights is that it uses traditional incandescent bulbs. These bulbs waste a major proportion of energy to heat and only 3-6% of total energy is converted to light, so there is a need to replace these bulbs with more energy efficient lamps.

EFFECTIVENESS

Lighting plays an essential role in human activities in all the sectors. There is great scope available to save electricity by promoting following measures:

- Use CFL/LED instead of lamps
- Paint walls with bright colours as it reflect more light.
- Make habit to switch off unnecessary light points.
- Without utilization of proper Sun light, effective saving from lighting cannot be committed.

CHAPTER 9 : CHALLENGES OF IMPLEMENTING DSMPROGRAMS

In developing countries there is generally a low awareness of energy efficiency and DSM programmes, and therefore marketing is necessary to promote these. In the service area of a utility company, the sectors and end-users that can benefit from DSM need to be identified, customized programmes developed (and their cost effectiveness evaluated) and then a plan to market and implement the programmes needs to be prepared. Many industrial and commercial companies still have not carried out energy audits to collect reliable information on their current operations. While this maybe due to a failure by management to appreciate the potential benefits of energy efficiency, some companies will lack skilled personnel able to perform audits. Consideration should be given to using outside experts, as the cost will normally be well justified. Organizations conducting energy audits or advising on DSM measures need to: (Eskom DSM, 2004).

_ Have a knowledge and understanding of DSM systems and opportunities;

_ Demonstrate the competence and comprehensiveness of their assessment;

_ Consider the accuracy of their assumptions;

_ Be aware of the production and safety constraints of involved plants/companies.

Often as a result of completing an audit, a variety of DSM measures may be identified.
Load management programmes to increase energy efficiency need to
consider the following factors :

_ The cost to the customer;

_ Variations in the prices of electricity and other fuels;

_ The value of avoided losses resulting from improved electricity system
reliability;

_ Any potential losses in production when implementing DSM programmes. It is essential that a proper financial analysis of the benefits of energy efficiency improvement be carried out when considering setting up DSM activities. For example, too much emphasis may be placed on the initial cost of equipment used by DSM programmes rather than on life cycle costs. Also there is often a perception that electrical energy is a small component of overall cost and therefore there is little motivation to pay for DSM measures to modify load profiles. Where fuels are involved, proper sensitivity analyses may not be performed to take account of potential energy cost variations or inaccuracies in capital investment estimates.

All investments need to be justified as part of the procedure of finding funds for DSM projects. This applies both to funds from company internal resources and to funds from banks or other funding institutes such as international cooperation agencies and the World Bank. Without a competent evaluation of a project, it will be difficult to get funds approved, internally or externally. The failure to get funds is one of the most important challenges of implementing DSM projects.

CHAPTER 10: EXISTING DSM INSTITUTIONS AND INITIATIVES IN IDENTIFIED INDIAN STATES

To be able to identify the most appropriate institutional framework for DSM in India, it is necessary that we understand the status of EE&DSM initiatives undertaken by existing institutions and identify barriers faced by those institutions and the lessons which can be learnt. For this purpose, we identified four States viz, Maharashtra, Haryana, Chhattisgarh and Gujarat. An approach involving secondary research through literature survey and primary research with 'one on one' meetings with key stakeholders was adopted to collect information on EE&DSM initiatives undertaken by these States. For 'one on one' meetings with key stakeholders, questionnaires were developed which addressed the following aspects with respect to each of the stakeholder:

• State Electricity Regulatory Commission

o Directives, Guidelines to distribution utilities

o Tariff based incentives/penalties for DSM

o Recovery of DSM related costs through ARR

o Capacity building initiatives in SERC and the distribution utility;

• Distribution Utility

o Presence of DSM Cell; structure; functions

o DSM initiatives; implementation mechanism; challenges

o Need for other stakeholder support e.g. SDAs

• State Designated Agencies

o Organisation structure for EE&DSM

o Implementing Mechanism

o Study of energy conservation action plan

o Need for other stakeholder support while implementation e.g. Distribution Utility The following sections present our analysis of the abovementioned issues for each State.

10.1 Maharashtra

Maharashtra is the pioneering State in the country to undertake EE&DSM activities. The Maharashtra Electricity Regulatory Commission (MERC) was established in August 1999, under the erstwhile Electricity Regulatory Commissions (ERC) Act, 1998, with the powers to determine tariffs, regulate power purchase, and promote competition, efficiency and economy in the electricity sector. Subsequent to the enactment of the EA 2003, the powers of MERC have been broadened, and several Regulations like Standards of Performance, Supply Code, etc., have been notified. The consumers in the State of Maharashtra are supplied electricity by one of the following five distribution licensees:

1. Maharashtra State Electricity Distribution Co. Ltd. (MSEDCL)
2. The Tata Power Company Ltd (TPC)
3. Reliance Energy Ltd. (REL)
4. Brihan-Mumbai Electricity Supply and Transport Undertaking (BEST)
5. Mula – Pravara Electric Cooperative Society (MPECS)

Out of the abovementioned five entities, all utilities except MPECS supply power in different parts of Mumbai while MSEDCL supplies power in entire Maharashtra except part of Mumbai which is supplied by TPC, REL and BEST. Maharashtra thus, has the most varied mix of distribution utilities in the country, which has the presence of two private distribution licensee, the largest (in terms of sales and revenue) public sector distribution licensee in the country, one local authority vested with the distribution licence, and finally one rural co-operative distribution licensee. Further, in exercise of power conferred under clause (d) of section 15 of EC Act, the Government of Maharashtra has designated Maharashtra Energy Development Agency (MEDA) to coordinate, regulate & enforce the provisions of EC Act within the State of Maharashtra in March 2003. MEDA also operates as State Nodal Agency of the Ministry of New and Renewable Energy in the State of Maharashtra.

In the following sub-sections, various EE&DSM initiatives undertaken in the State by these organisations are discussed.

10.1.1 Maharashtra Electricity Regulatory Commission (MERC)- MERC recognised the importance of end-use EE&DSM in the overall context of the huge demand-supply mismatch prevalent in the State of Maharashtra which was resulting in consumers facing prolonged hours of load shedding. MERC has been actively promoting efficient utilisation of electricity, its conservation and DSM as a power shortage mitigation strategy, by exercising the power vested in it to regulate supply, distribution, consumption or use of electricity in times of exigencies under Section 23 of the EA 2003. Various initiatives undertaken by MERC have been summarised in the following paragraphs:

A) Directives / guidelines for distribution utilities in the State

• Directive to prepare DSM Plan and undertake DSM & EE/EC Programmes The Commission, in its Order dated March 4, 2005, on a petition filed by a consumer organisation seeking the Commission's direction to the largest distribution Utility in the State (MSEDCL) to undertake steps, including implementation of DSM and EE programmes, to ward off load shedding that was being resorted to by MSEDCL to balance its demand-supply situation; directed MSEDCL to submit a DSM plan for capturing energy conservation (EC) and energy efficiency (EE) potential in various electricity-consuming sectors in Maharashtra. Subsequently, when the prospect of a prolonged phase of load shedding began to loom large over the city of Mumbai, which hitherto had not witnessed load shedding, the Commission directed the distribution utilities supplying power in Mumbai city, viz., BEST, REL and TPC, to prepare DSM plans and undertake DSM and EE/EC programmes.

• Formation of DSM Cell

The Commission has directed all distribution utilities in the State to develop necessary infrastructure for implementation, monitoring and verification of DSM programmes. The Commission has also suggested that all distribution utilities in the State should create a dedicated DSM Cell to carry out various DSM related activities.

• Load Research

Distribution Utilities in the State does not have category-wise demand and consumption data beyond the system level demand i.e. data on contribution of sector or segment or end-use or technology to the total demand and consumption, both, in terms of quantum or timing. In the absence of such data, it is difficult to strategies and plan EE&DSM programmes. Consequently, the EE&DSM initiatives undertaken so far by the Utilities in the State have been adhoc, and at best have been in the nature of demonstration or pilot projects. Recognising the absence of planning data as a major constraint for speedy development and implementation of full-fledged EE&DSM programmes, the MERC through its Multi Year Tariff (MYT) Orders of April/May 2007, directed all the distribution Utilities in the State to undertake systematic load research and to make load research an integral part of their the day-to-day operations.

• Recovery of DSM/energy efficiency related costs

Recognising that the distribution utilities, who are regulated entities, would need to recover costs associated with undertaking of EE&DSM programmes, MERC allowed distribution utilities in the State to specifically recover all costs incurred by the distribution utilities in any EE&DSM related activity, including planning, designing, implementing, monitoring and evaluating EE&DSM programmes through their aggregate revenue requirement.

• Cost Effectiveness Assessment Guidelines Draft, January 2009:

It is recognised by MERC that the DSM programmes undertaken by the distribution utilities need to be cost effective for the consumers as well as to the distribution utilities themselves. To ascertain the cost effectiveness of the DSM programmes, MERC has prepared draft guidelines to provide guidance to the distribution utilities for assessing the cost effectiveness of the DSM programmes and thus reduce the uncertainty faced by the distribution utilities in regulatory approval. Further, this guideline was prepared to reduce the regulatory burden while scrutinising DSM programme proposal from the distribution utilities.

• Overall Regulatory Framework for DSM

While MERC had earlier issued directives and guidelines, clarity was necessary on the regulatory framework it would adopt. In response to this requirement, MERC, in June 2009 prepared a draft discussion paper on the Regulatory Framework for DSM. The framework discusses:

- Possible policy objectives of MERC vis-à-vis DSM
- Guiding principles of MERC for the DSM efforts in the State
- Eligibility criteria for DSM programmes too be allowed by MERC
- DSM under multi-year tariff regime
- Institutional structure for management of DSM in the State
- Targets and funding levels
- Procedure for approval of DSM plans/programmes
- Criteria for inclusion of DSM programmes in five year DSM plan
- Evaluation, measurement and verification
- Monitoring and reporting
- Post Programme reporting
- Possible contents of a DSM Plan Document

- Possible Contents of a DSM Programme Document

B) Tariff signals

In order to provide appropriate signals to the consumers to adopt EE&DSM measures, MERC deemed it necessary to provide tariff signals to the consumers in higher consumption bracket as well as certain categories of consumers like shopping malls, multiplexes, advertisement hoardings, etc. Accordingly, through the April/May 2007 Multi Year Tariff Orders for distribution utilities in the State, the Commission steeply increased the tariffs applicable to the abovementioned categories by around 80% to 100% with a view to provide them an economic signal to adopt appropriate EE measures. Further, instruments such as 'Time of Day' tariffs for several categories, Power Factor incentives/penalties and Additional Supply Charge have been used by the Commission for load management.

C) Capacity building within MERC

MERC created a dedicated DSM Cell within itself in early 2006, to facilitate the regulatory processes related to EE&DSM activities. Further, recognising that the distribution utilities in the State have limited experience and knowledge in establishment of EE&DSM programme development, financing and implementation, the MERC provided support and guidance to the distribution Utilities in this regard. Further, the Commission entered into a Memorandum of Understanding (MOU) with the California Energy Commission (CEC), California Public Utilities Commission (CPUC) and Lawrence Berkeley National Laboratory (LBNL) of the United States, to develop its own capacity and also that of the distribution utilities in the areas of load research, integrated resource planning, demand response, etc.

10.1.2 Reliance Energy Limited (REL)

REL incorporated DSM Cell in their organisation in July 2007. The existing Cell is headed by Assistant Vice President and four junior management cadre executives (Fig 5-1). The executives have experience in various fields such as marketing, utility operations, Energy Audits etc. The Cell has submitted various EE&DSM proposals to MERC and is awaiting approval. The Cell keeps in loop other executives of the organisation who are Certified Energy Auditors/Managers, so that as and when the DSM programmes are approved, the resources are available within the organisation. The Cell undertakes various activities including load research, energy audit of consumers, internal office energy efficiency improvements and development of EE&DSM ideas among others.

Figure 10.1 Existing DSM Cell structure in Reliance Energy Limited, Mumbai

EE&DSM Initiatives by REL

• Reliance Energy CFL Scheme: The objective of the scheme was demand and energy saving during peak hours. Under the scheme, energy saving CFL worth Rs. 165 was provided at Rs. 63 with monthly installment of Rs. 7 for 9 months. The scheme was implemented in two phases – pilot scheme and main scheme. 2.05 Lakh consumers participated in the programme and 6.17 Lakh CFLs were distributed. This resulted in energy saving of 16.85 MU per annum and demand saving during peak time of 10.79 MW.
• Energy audit scheme: Under this scheme which is open for any non residential consumer having load > 5kW, initially the consumer pays 25% of the energy audit fees. If the consumer implements 50% of the measures suggested in the audit, the fees is refunded back to the consumer. More than 30 energy audits have already been done. • Load research and preparation of five year plan: The Cell has completed load research of 2007-08; load research for 2008-09 will be completed by October'09. The REL has appointed consultants to prepare five year plan for the Cell. • Project on street lights: Under this project, replacement of High Pressure Mercury Vapour (HPMV) with Medium Pressure Sodium Vapour (MPSV) was carried out. Estimated savings in Energy terms is 4.56 million kWh per year and in demand terms it is 1.1 MW. • Apart from these programmes, REL has also undertaken other programmes such as DSM Bidding for 8th Khar Road through ESCO mode, New CFL programme, Capacitor installation programme, etc

REL implemented most of these programmes through manufacturers with REL negotiating the best price on behalf of the consumers who pay for the equipment/service. Marketing and consumer awareness campaign is also undertaken by REL.

Some of the challenges faced by REL in implementation of programmes include delay in approval of programme by the regulator, prioritisation of programmes and determination of market scale required to be adopted. Apart from these, M&V is found to be the most challenging aspect of programme implementation.

REL recognises that the utility infrastructure for EE&DSM activities will largely depend on the kind and number of DSM programmes. REL has drafted proposed the following organization structure for the DSM Cell.

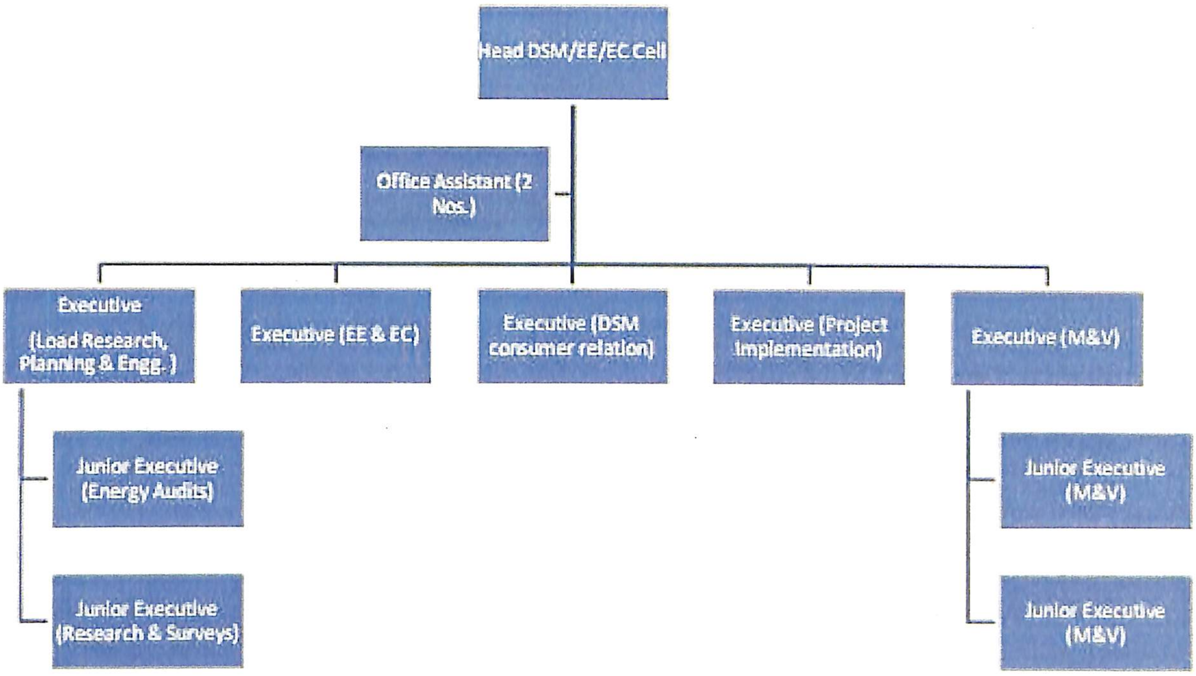


Figure 10.2 Proposed DSM Cell structure

With regard to working with MEDA, the State Designated Agency, REL experienced that the programmes initiated by MEDA are generally restricted to rural areas and are not available for the urban areas. REL recognises that MEDA has very useful database, capacity and experience required for designing EE&DSM programmes and a collaborative approach with it could add significant impetus to the whole efforts.

10.1.3 Tata Power Company (TPC)

In response to MERC directive, TPC incorporated DSM Cell in March 2008. The existing Cell consists of three members with experience in generation, transmission and distribution businesses all of whom are Electrical Engineers. One member of the team is also BEE Certified Energy Auditor. The Cell also keeps in loop other

executives of the organisation who are Certified Energy Auditors/Managers so that as and when the DSM programmes are approved, the resources are available within the organisation. TPC recognises that as and when DSM programmes are approved by MERC, more team member will be required for implementation.

The Cell undertakes various activities including load and market research, consumer awareness through exhibitions, conferences, energy audit and internal energy efficiency improvements among others. TPC has appointed a consultant for formulation of three year plan for EE&DSM activities. TPC undertook a demonstration project in lighting sector which involved replacement of T-8 fluorescent lamps and conventional ballasts by T-5 fluorescent tubes with electronic ballasts. 50,000 tube lights were replaced in the LT commercial and LT industrial consumers' premises. One of the major ongoing activities in TPC is in-house lighting improvement programme. Total of 1800 FTLs are being replaced by T-5 and electronic ballast. Floor wise Central Monitoring System (CMS) has been put in place and feeders for lighting, personal computer and air-conditioning load have been separated.

The challenges faced by TPC are primarily implementation challenges such as availability of premises only on weekends, changes required to false ceiling, need of direct supervision, improper wiring in old building and LT commercial consumers where building is on lease, etc. One of the areas where TPC expects challenges is independent Monitoring and Verification. TPC is of the opinion that in future independent agency may be required to undertake M & V.

10.1.4 Brihan Mumbai Electric Supply & Transport Undertaking (BEST)

In response to the MERC directive, BEST incorporated DSM Cell in its organisation in June 2008. The existing Cell is a three member team with experience in distribution business in the electricity sector (Figure 5-3). All the members of the team are Electrical Engineers/diploma while one of them is also BEE Certified Energy Auditor. The Superintending Engineer is responsible for M&V activities and Assistant Engineer for implementation of ongoing DSM projects.

Figure 10.3 Existing DSM Cell Structure in BEST

The cell proposes to undertake various activities including load research, DSM potential assessment, and preparation of DSM plan, implementation and M&V activities. BEST is also considering appointment of consultants for carrying out these activities.

One of the programmes proposed by the BEST is replacement of 40 W FTLs having electromagnetic chokes with 36 W FTLs having electronic chokes in Mumbai Municipal Corporation Hospitals. This programme is being financed through the Load Management Charges Fund. As part of the M&V, sample of 30 per 1000 FTLs will be taken. The wattage of the old tube-light will be measured and hours of usage will be metered through hour meter. BEST is in the process of developing DSM programme for high-rise building for which it has already undertaken energy audit of water pumping systems in ten high rise buildings.

Some of the challenges faced by BEST include requirement of energy auditors and staff at lower levels. BEST has been participating in FOR training programmes for capacity building. BEST believes it has in-house capacity for undertaking M&V activities and shall seek consultants support for financial matters.

10.1.5 Maharashtra Energy Development Agency (MEDA)

Registered as a Society in July 1985, MEDA as an organization commenced functioning from July 1986. MEDA's objective is to undertake development of renewable energy and facilitate energy conservation in the State of Maharashtra. MEDA is a state nodal agency under the umbrella of the Ministry of New and Renewable Energy (MNRE). Further, in March 2003, in exercise of power conferred under Section 15(d) of the EC Act, the Government of Maharashtra has designated MEDA as State Designated Agency to coordinate, regulate & enforce the provisions of EC Act. Therefore, it is MEDA's prime responsibility to carry out energy conservation activities in the state of Maharashtra. The organisation structure within MEDA responsible for energy conservation activities in the State is shown in Fig.

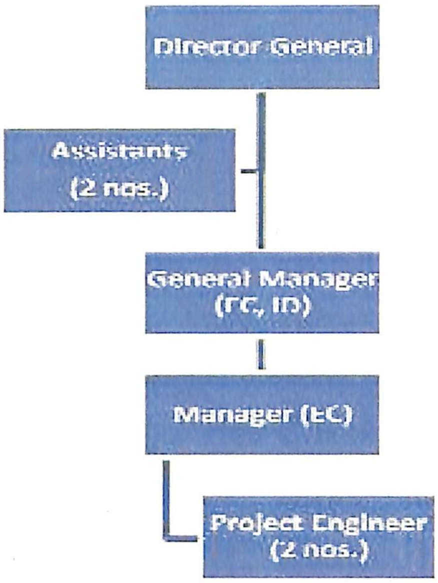


Figure 10.4 Organisation Structure of EC officials in MEDA

Strategic Action Plan The MEDA, consistent with its responsibility as State Designated Agency, has developed and released Strategic Energy Conservation Plan as a blueprint for energy conservation activities in the State of Maharashtra. This Plan, which develops mechanisms to balance the State's electricity supply and demand includes the following key elements:

- Statutory responsibilities of MEDA under the EC Act
- Implementation of a set of Energy Conservation Programmes
- Establishment of an Energy Conservation Fund
- Development of databases and promotional campaigns
- Capacity building for development, implementation and evaluation of energy

conservation programmes

Energy Conservation Programmes To achieve the objectives set out in Strategic Energy Conservation Plan, MEDA has developed a set of proactive energy conservation programmes. These programmes will be implemented in cooperation with the relevant state government agencies and the private sector. The 11 programmes for which MEDA has already developed preliminary designs are as follows 1. Home Bright : Residential high efficiency lighting programme (Replacement of Incandescent Lamp by Compact Fluorescent Lamp (CFL)) 2. Agricultural Efficiency: Installation of capacitors on pump sets 3. Bright Streets: Municipal Street Lighting using advanced technology 4. Municipal Energy Efficiency programme: Improvement of energy efficiency in municipal pumping and street lighting 5. SME Programme: EE improvement in small and medium enterprises 6. Public Buildings Partnership Programme: Energy efficiency implementation in public buildings using ESCOs as the implementing mechanism 7. Green Buildings Programme: Cooperate with existing Green Buildings Centre; construct one or two new Green Buildings in Maharashtra 8. Solar Water Heating: Solar Water Heating Programme 9. Work Bright Programme: Commercial High-Efficiency Lighting Programme 10. Motor RE-Power: High Efficiency Motor Rewinding Programme 11. Financing of EE improvement using the Energy Conservation Fund 12. Awareness Programme on Energy Conservation and Electrical Safety State Level Energy Conservation Committee In order to guide MEDA on matters related to Energy Conservation Policy, Government of Maharashtra has constituted State Level Energy Conservation Committee in April 2005 under the Chairmanship of Principal Secretary (Energy) and 15 members from various government departments and energy sector.

Potential Assessment

MEDA has also carried out assessment of potential for energy conservation in the State. As per MEDA assessment,

- The greatest consumer of electricity in Maharashtra is the industrial sector. It consumes about 37.58% of the total generated energy. The potential for energy conservation in this sector is 25%, which means avoided capacity of 726 MW.
- The agriculture sector consumes about 18.82%of the total generated energy. The potential for energy conservation in this sector is 30 per cent, which means avoided capacity of 436 MW.
- The commercial sector consumes about 9.47 per cent of the total energy generated. The potential for energy conservation in this sector is 30 per cent, which means avoided capacity of 220 MW.
- The domestic sector consumes about 25.65 per cent of the total generated energy. The potential for energy conservation in this sector is 20 per cent, which means avoided capacity of 396 MW

Other Activities undertaken by MEDA to implement EC Act 2001

- Industry energy audit is continuing activity since 1987
- MEDA signed MoU with IIEC for DSM under ECO II Project of USAID.
- DSM study in Nashik and Thane Municipal corporations.
- Save Energy Programme Status: 379 industrial energy audits which resulted in saving of energy worth Rs. 27.61 crore
- MEDA signed MoU with Alliance to Save Energy (ASE) and United States Asia-Environmental Partnership (USAEP) for energy audit in Pune Municipal Corporation
- Taking massive awareness programme for energy conservation
- Energy efficiency awards instituted for different sectors

10.2 Haryana

Haryana was the second State in India to initiate the process of Reform & Restructuring of the power sector in India. Haryana Electricity Regulatory Commission (HERC) was established on 17th August 1998 as per the provisions of the Haryana Electricity Reform Act, 1997. Under the reform process, Haryana State Electricity Board (HSEB) was unbundled into two corporate bodies namely Haryana Power Generation Company Limited (HPGCL) for the Generation of Power and Haryana Vidyut Prasaran Nigam Limited (HVPNL) for the Transmission & Distribution of power within the state of Haryana. Subsequently, with effect from 1st July 1999, the activity of distribution and retail supply of power has been entrusted, to Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL) for north and Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL) for south circles of Haryana.

Further, the Government of Haryana has designated the Department of Renewable Energy as the Designated Agency to co-ordinate, regulate and enforce the provision of the EC Act in the State of Haryana. The Haryana Government has identified energy conservation as one of the thrust areas and many initiatives have been taken in this regard. In the following sub-sections, various EE&DSM initiatives undertaken by various organisations in the State are discussed.

10.2.1Haryana Electricity Regulatory Commission (HERC)

HERC has issued directives in its tariff orders to distribution utilities to undertake various EE & DSM measures. Though the Commission does not have DSM Cell it has been very active in pursuing EE&DSM initiatives and has issued several directives/guidelines to the utilities in the State.

Guidelines The HERC issued Guidelines for Load Forecasts, Resources Planning, and Power Procurement Process for compliance by the licensees as provided in transmission and Bulk Supply Licence and Distribution and Retail Supply Licence in July 1999. Section 2.3(a) of the guidelines state: The Commission may from time to time specify particular matters which should be dealt with in the Load Forecasts .These shall include, inter alia, the following: a) Demand Side Management (DSM) programmes and anticipated increases in end use efficiency. HVPNL and Distribution and Retail Supply. Licensees shall co-ordinate the planning and implementation of their respective DSM programmes.

The Demand Side Management Programmes have been defined in the guidelines as "These are programmes introduced and administered by electricity supply companies with the object of encouraging more economical and efficient use of power, as an alternative to increasing supply. While the programmes may include any action which reduces demand, including more efficient use of energy by the utility itself, DSM usually emphasises involvement of the end user. The programmes may utilise rates, for example, time of day tariffs that encourage customers to shift their consumption to the lower cost part of the load curve or tariffs linked to metering that discourage excessive power consumption."

Directives to Utilities

The Commission in its Tariff Order 2003-04 directed the licensee to establish DSM Cell for proper monitoring of DSM activities. An annual report was required to be submitted to the Commission by 30th April every year. However, no such report was submitted. The Commission directed the utilities in Tariff Order 2004-05 to comply with this direction of the Commission. Subsequent orders of HERC are silent on the issue of DSM directives and their implementation.

10.2.2 Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL)

While UHBVNL has undertaken several DSM programmes, it is yet to establish dedicated DSM Cell. Currently, all programmes are being undertaken in decentralised manner under direct control of the Managing Director of the company. The Utility is planning to constitute a Cell with SE level officer who may report to either Haryana Power Procurement cell or directly to Managing Director.

EE&DSM Initiatives by UHBVNL

• UHBVN started CFL distribution with BPL consumers, which it subsequently extended to all the domestic consumers. As on June 2009, it has distributed around 75000 CFLs of 14 W each.

• AP feeder separation is at completion stage. Rescheduling of supply to AP feeders in staggered manner is expected to reduce peak significantly.

• UHBVN has a major proportion of its energy sales to agriculture consumers. Therefore, it is of vital importance to undertake DSM initiatives in the agriculture supply. In this regard, UHBVN plans to introduce High Voltage Distribution System (HVDS) in the existing agriculture feeders.

• UHBVN has initiated programme similar to Solapur AgDSM for two feeders in Kaithan sub-division. For pumping efficiency improvement, ESCO mode is being explored.

The Monitoring and verification of savings in terms of energy and rupees has not been done so far by the Utility. The Utility is keen to implement Bangalore Electricity Supply Company's (BESCOM) PF improvement measure at feeder level. With regard to support from other organisations, UHBVN suggested that BEE may depute a competent officer to assist UHBVN in development of EE & DSM plan and to assist in monitoring and verification of DSM projects.

10.3 Chhattisgarh

Chhattisgarh is a new State which was carved out of Madhya Pradesh in November 2000. It is one of the few states in the country, which has a robust power sector since its inception. In the state of Chhattisgarh, the Chhattisgarh State Electricity Regulatory Commission (CSERC) was constituted by the Government of Chhattisgarh vide

Notification No. 3190/S/E/2002 dated 23/08/2002 read with Notification No. 432/R/352/03 dated 11/05/2004.

Chhattisgarh State Electricity Board (CSEB) was a statutory body constituted under Section 5 of the since repealed Electricity (Supply) Act, 1948. In January 2009, the CSEB has been unbundled into five independent Companies viz. Holding company, Generation Company, Transmission Company, Distribution Company and Trading Company. Chhattisgarh State Power Distribution Company Limited (CSPDCL) is a State Power Distribution Company responsible for distribution and supply of electricity in the State of Chhattisgarh.

Chhattisgarh State Renewable Development Agency (CREDA) was established in May 2001 to promote non-conventional and alternative energy sources. CREDA has been constituted under Department of Energy, Govt. of Chhattisgarh for implementation of various schemes pertaining to Renewable Energy sources and Energy Conservation. Registered under The Societies Act 1973, controlling body of CREDA is the governing body with Energy Minister, as Chairman. The Government of Chhattisgarh notified CREDA, as the Designated Agency to coordinate, regulate and enforce the provision of the EC Act and implement schemes under the said Act within the state if Chhattisgarh. In the following sub-sections, various EE&DSM initiatives undertaken in the State by these organisations are discussed.

10.3.1 Chhattisgarh State Electricity Regulatory Commission (CSERC)

Chhattisgarh State Electricity Regulatory Commission (CSERC) has been proactive in the area of EE&DSM. Considering the ample scope for reducing costs and increasing efficiency in the operation of erstwhile CSEB, the CSERC has given several directives to erstwhile CSEB in the last three tariff orders. The initiatives undertaken by CSERC can be summarised in the following categories:

- Capacity building of CSERC

Although CSERC does not have a dedicated DSM cell in the Commission, it is in the process of implementing staffing pattern as suggested by FOR. For capacity building within the organisation, Director and Dy. Director level officers of Commission are regularly attending BEE/FOR workshops for the EE & DSM.

- Directives to utilities

1.In its Tariff Order 2005-06, the Commission directed the Board to take up the work of energy audit and demand side management in the selected areas of large industrial consumers and large agricultural consumers.

Directive in Tariff Order 2005-06 "The Board shall take up the work of energy audit and adoption of demand side management practices. These works may be taken up in selected pockets, preferable in large industrial pockets such as Raipur, Bhilai, Bilaspur and Raigarh district and also in pockets of large agriculture consumption say Dhamatrim Rajim, Mahasamund, Durg, Balod, Kawardha and Rajnadgaon. The Board's own power stations, administrative office complexes and colonies should also be subjected to energy audit. The Board shall urgently take up energy audit of Raipur, Bhilai, Dhamtri, Durg and Rajnandgaon in the first phase and submit a quarterly report on the above."

2. Subsequently, in the Tariff Order of FY 2006 -07, the Commission directed the CSEB to take up DSM activities. Directive in Tariff Order 2006-07 "The Board is again directed to undertake the studies systematically and take up at least one significant measure of DSM."

3.Directive in Tariff Order 2007-08

"Demand side management is an important area which should be in focus in the Board, particularly in the context of the unmanageable spike in the peak load. TOD tariff is one of the measures which this order contains. Fortunately, the Board appears to be conscious of this aspect and has referred to various measures for energy conservation in Para 2.5 of its application. However, the objective could be achieved only if the Board takes bold and effective steps to implement the measures catalogued in the application. Presently they would appear to be in the drawing board only. Some of these measures such as support to domestic consumers to use CFL lamp through payment in instalments, in association with CFL manufacturers; free distribution of CFL to BPL consumers; support to local bodies for change-over to CFL or T8 tubelight fitting in street lights; and promotion of energy efficient pumps etc;, can be taken up quickly provided detailed implementable schemes are prepared in collaboration with manufacturers of CFL and other equipments where necessary. The Commission would be willing and happy to grant concession in tariff for consumers who adopt these measures.

The CSEB should prepare workable schemes as early as possible. To begin with, at least on use of CFL in place of incandescent lamps and energy efficient pumps schemes should be taken up. It would be useful if uses of CFL and of energy efficient pumps are made necessary condition for all new connections. However, the Commission would like to leave it to the Board to come with workable schemes."

4. CSERC Order 2009 on 'Pricing of power required to be purchased in the short-term from captive generating plants and IPPs'

"...TOD tariff has been implemented for large consumers in the State in order to flatten the peak load curve and for energy conservation during peak hours. The other DSM measures may also be adopted by CSPDCL to limit the peak demand..."

5. Energy Efficiency Cells at generating stations

For reduction in Auxiliary Power Consumption (APC), the Commission suggested in its Tariff Order 2005-06 that the Board should set up an Energy Efficiency Cell in each power plant which shall monitor coal consumption, coal handling, specific heat rate, specific oil consumption, auxiliary consumption, break downs, pollution, etc. on a regular basis, examine the reasons for deviations and suggest measures for improvement.

6. Allow recovery of DSM/energy efficiency related costs Interaction with CSERC officials indicate that the Commission is keen to allow various DSM related projects in ARR.

• Tariff signals

In order to provide appropriate signals to the consumers to adopt EC/EE measures, variety of tariff signals is given to the consumers. These include Time of Day tariff, power factor incentives/penalties and load factor penalty/incentives.

10.3.2 Erstwhile Chhattisgarh State Electricity Board (CSEB)

The EE&DSM activities that were being undertaken by the erstwhile CSEB are now under the purview of CSPTCL. Although a DSM Cell has not yet been constituted in the Organisation, an Executive Engineer (EE) level officer is looking after these activities. Based on the Commission directive to erstwhile CSEB, CSPTCL is carrying out DSM study with the help of consultant. As the restructuring process progresses, this charge is likely to be handed over by CSPTCL to CSPDCL. The consultants have recommended constitution of DSM cell in the Distribution Utility with Superintending Engineer level officer directly reporting to Managing Director. The Superintending Engineer shall be supported by two Executive Engineers which in turn will be assisted by Assistant

Engineers. The Utility is keen to set up such a DSM Cell and also implement consultants' suggestions.

As part of EE&DSM initiative, a consultant has been hired for the CDM based CFL distribution. Presently two villages are covered for CFL distribution. The CFL distribution work has been completed in Aari Village in Rajnandgaon Dist under this scheme.

10.4 Gujarat

Under the reform process, in April 2005, erstwhile Gujarat Electricity Board (GEB) was reorganized into Seven Companies with functional responsibilities for trading, generation, transmission and distribution etc. The Companies incorporated are:

Gujarat Urja Vikas Nigam Ltd. (GUVNL) - Holding Company

– Gujarat State Electricity Corp. Ltd.(GSECL) – Generation

– Gujarat Energy Transmission Corp. Ltd.(GETCO) – Transmission

– Uttar Gujarat Vij Company Ltd. (UGVCL) - Distribution

– Dakshin Gujarat Vij Company Ltd. (DGVCL) – Distribution

– Madhya Gujarat Vij Company Ltd. (MGVCL) - Distribution

– Paschim Gujarat Vij Company Ltd. (PGVCL) - Distribution

The GUVNL is engaged in the business of bulk purchase and sale of electricity, supervision, coordination and facilitation of the activities of its six subsidiary companies. The GSECL is engaged in the business of generation of electricity. The GETCO is engaged in the business of transmission of electricity. The UGVCL, DGVCL, MGVCL and PGVCL are engaged in the business of distribution of electricity in the northern, southern, central and western areas of Gujarat respectively.

The Gujarat Electricity Regulatory Commission (GERC) was originally established under the Electricity Regulatory Commission Act (ERC), 1998. The Commission subsequently assumed powers conferred on it under the Electricity Act 2003.

Gujarat Energy Development Agency (GEDA) is the Nodal Agency of the Government of Gujarat for promotion and popularization of Renewable Energy and State Designated Agency for Energy Conservation in the state of Gujarat, India.

10.4.1 Gujarat Electricity Regulatory Commission (GERC)

The GERC is yet to set up dedicated cell for EE&DSM activities. Further, the Commission has preferred to implement EE&DSM measures related to tariffs such as time of day tariff and power factor penalty/incentives.

10.4.2 Uttar Gujarat Vij Company Limited (UGVCL)

Although UGVCL has not institutionalised a dedicated DSM Cell in the organisation, the EE&DSM activities are being coordinated by Superintending Engineer (Comm. /Division). The GUVCL is planning to form Energy Management Cell. In Gujarat, GUVNL (Holding Company) is responsible for coordination of various energy efficiency and DSM activities in the State of Gujarat. It prepares the yearly action plan for the implementation of various energy efficiency and energy conservation projects. GUVNL also sets and provides budgets for the implementation of suggested energy conservation and energy efficiency projects.

EE&DSM initiatives by GUVNL

– Agricultural Feeder Separation Programme
– Replacement of Incandescent bulb with CFL in Company's Own Buildings
– Installation of APFC panel for Industrial/Urban and Agricultural Feeders
– Consumer Awareness Programme to promote EE & EC
– Replacement of inefficient Agri Pump sets with high efficiency ones

Replacement of inefficient Ag Pumpsets with high efficiency Pumpsets

The Utility has undertaken replacement of inefficient agriculture pump-sets with high efficiency pump-sets. The programme is a State Government Project with State Government, GUVNL (Holding Company), UGVCL (Distribution Utility), GEDA (State Designated Agency) & Farmers as the stakeholders. Salient features of the programme are given below:

– GEDA identified various Ag pumpsets manufacturers & approved them as GEDA approved Ag. Pumpsets manufacturers.

– GEDA has prepared technical specifications, innovative financing mechanism & M&V mechanism for the effective implementation of the projects
– UGVCL is the main implementing body
– Farmers, interested in participating in this programme, contact UGVCL.
– UGVCL person visits the site & confirm the ratings of the pumps & suggest the new pumpsets
– Farmers select the new pumpsets from the various GEDA approved manufacturers
– Pump manufacturers install the new pumpsets
– Old pumpsets are taken back by UGVCL & will be scrapped
– With regard to payment, farmers pay one third amount of cost of the new pumpsets. The remaining amount is paid by UGVCL. Utility gets the same amount from the State Government at the later stage
– Out of total applications of 3800, implementation of 1500 has been completed.

All other utilities are undertaking programmes on similar lines as these programmes are primarily designed by GUVNL for all implementation by all utilities in the State.

10.4.3 Gujarat Energy Development Agency (GEDA)

In GEDA, the Energy Conservation Department was incorporated in 1985. Various initiatives of GEDA include replacement of inefficient agriculture pump-sets with new pump-sets; subsidised industrial energy audit; walk through energy audit for SME sector for 2000 enterprises; demonstration of EE technology for diamond process industries; awareness and training programmes for designated industries, consultants, educational sectors; promotion of innovative energy efficiency devices (for example: CFL, LED) and energy audit of Government buildings. The mechanism adopted by GEDA include hiring of manufacturers of specific technology providers, appointment of consultants for preparation of the feasibility report and appointment of ESCO/Consultants for the implementation of identified energy conservation measures.

CHAPTER 11: REVIEW OF INTERNATIONAL BEST PRACTICES

For the purpose of international survey, the case of California energy efficiency and Vermont Energy Efficiency has been considered. Both California and Vermont are leading States in establishing energy efficiency as an integral part of the electricity business. The administrative structures adopted in the two States for energy efficiency programs are different from each other. These have been chosen to get a wide perspective on possible institutionalising mechanisms for energy efficiency.

11.1Energy Efficiency Initiatives in the California In California the energy sector is regulated by three regulatory bodies: Federal Energy Regulatory Commission (FERC), California Public Utilities Commission (CPUC) and California Energy Commission (CEC). FERC regulates the interstate transmission of electricity, natural gas and oil. CPUC regulates California's privately owned electric, natural gas, water, telecommunications, railroad, rail transit, and passenger transportation companies. It also plays a key role in making California a national and international leader on a number of clean energy initiatives and policies designed to benefit consumers, the environment, and economy. CEC is California's primary agency for energy policy and planning. One of the responsibilities of CEC is to promote energy efficiency by setting appliance and building standards and work with local governments to enforce those standards.

11.1.2Investor & Publicly owned utilities in California

Investor owned utilities in California are Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric. Investor-owned utilities administer programmes with overall oversight by the CPUC, which establishes key policies and guidelines, such as setting programme goals and approving spending levels. A certain share of public benefits funding is designated to go to non-utility organizations. California's publicly owned utilities such as large municipal utilities serving Los Angeles & Sacramento fund & provide programmes to their customers.

11.1.3 Administrative structure for EE programmes

In 2003, CPUC and CEC jointly developed and adopted the Energy Action Plan. The plan established a 'loading' order of energy resources that first optimizes increased conservation and efficiency. The same was reaffirmed in Decision (D.) 04-12-048 on Long-Term Procurement Plan of IOUs. The goal was to reduce the per capita energy use and reduce toxic emissions and greenhouse gases through increased conservation and efficiency. The approved funding was increased for the plan by CPUC at the beginning of year 2004 by instructing the utilities to integrate cost effective EE programmes into resource planning.

In 2005, Decision 05-01-055 on Interim Opinion on the Administrative Structure for Energy Efficiency: Threshold Issues was adopted. The decision established new Administrative Structure for Post-2005 Energy Efficiency Programmes. The objective was to develop common language, shared view of administration functions and roles, and to establish criteria for evaluation proposals. The structure placed utilities in lead role for developing programme plans & managing portfolios with input from advisory groups. It required that utilities put at least 20% of the total portfolio to bid to non-utility implementers in each planning cycle. It established safeguards: advisory group structure, competitive bidding minimum requirements and ban on affiliate transactions. Responsibility of all EM&V studies, policy oversight, research & analysis, quality assurance, dispute resolution was placed on CPUC Energy Division. Further, for research and analysis & EM&V Energy Division & CEC staff was proposed to work in collaborative manner (Figure 6-1)

The energy efficiency programs in the State are guided by the Policy rules contained within the Energy Efficiency Policy Manual. The Manual is a 'living document' updated periodically to reflect Commission's new policies and other changes

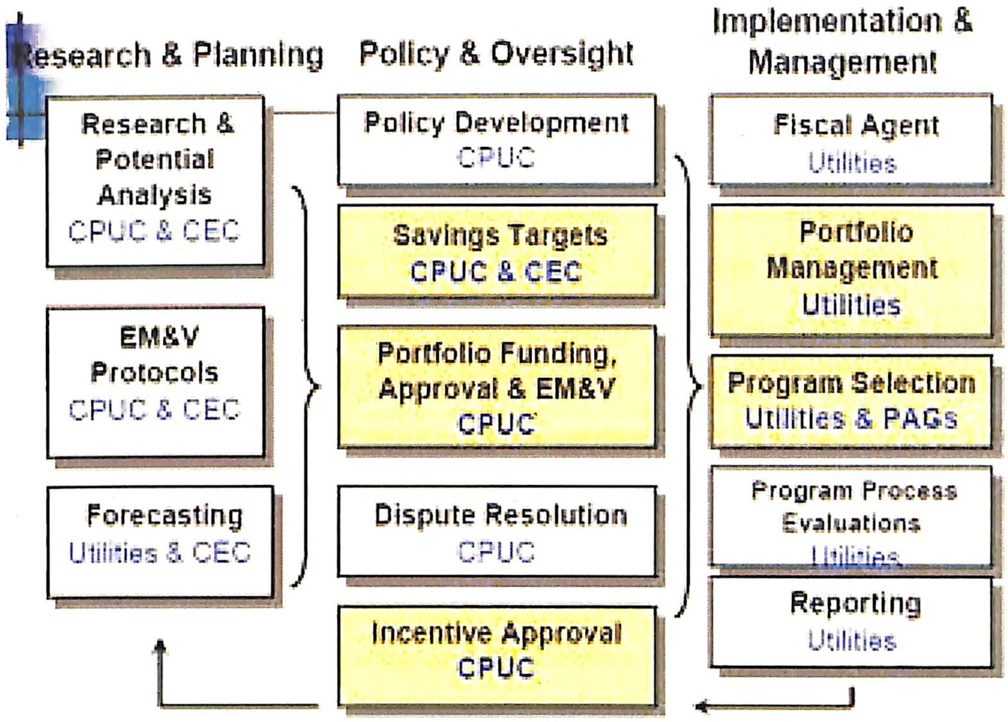


Figure 11.1 EE Program Administration in California: Post 2005

Further, Commission issues decisions addressing specific topics as and when required on continuous basis. In September 2008, the CPUC adopted California's first Long Term Energy Efficiency Strategic Plan as a single roadmap to achieve maximum energy savings across all major groups and sectors in California. It is the State's first integrated framework of goals and strategies for saving energy, covering government, utility and private sector actions. This Plan was developed through a collaborative process involving the CPUC's regulated utilities –PG&E, SCE, SDG&E and Southern California Gas Company (SoCalGas) and over 500 individuals and organizations working together over an eleven-month period.

The EE programme administration post 2005 in California had role of two major players, CPUC and Utilities with some role of CEC. Under this structure the utilities played lead role for developing programme plans & managing portfolios with input from advisory groups. Both these entities with inputs from advisory groups and services from consultants and contractors were able to undertake all possible activities in a DSM process.

11.2. EFFICIENCY VERMONT

Vermont's electric distribution companies are regulated monopolies that operate under a "certificate of public good" granted by the Vermont Public Service Board (PSB or Board). As regulated monopolies, their rates and policies are subject to review by the Vermont Department of Public Service (DPS) and approval by the PSB. The PSB is a three member, quasi-judicial board that supervises the rates, quality of service, and overall financial management of Vermont's public utilities: electric, gas, telecommunication, private water companies and cable television companies. The Board also reviews the environmental and economic impacts of proposals to purchase energy supply or build new energy facilities; monitors the safety of hydroelectric dams; evaluates the financial aspects of nuclear plant decommissioning and radioactive waste storage; reviews rates paid to independent power producers; and oversees the state wide Energy Efficiency Utility. The Department of Public Service is an agency within the executive branch of Vermont State Government. Its function is to represent the public interest in matters regarding energy, telecommunications, water and wastewater.

Vermont has had extensive energy efficiency programmes since 1990. Originally, programs were run by the state's utilities under jurisdiction of the PSB, but in 1999 the PSB transferred these energy efficiency programmes to Efficiency Vermont, a state-wide "Energy Efficiency Utility" (EEU) supported by public benefits funding.

11.2.1Origin of Efficiency Vermont

The Energy Efficiency Utility concept was initially considered as a part of electric sector restructuring deliberations in 1996-97, but the Vermont Legislature did not proceed with restructuring and retail competition. At the same time, the Vermont Department of Public Service (DPS) was asked to produce a report that included a review of efficiency potential and utility administered energy efficiency efforts since 1990. The report concluded that a state-wide, non-utility alternative should be considered regardless of whether or not the state proceeded with restructuring. The primary benefits that the DPS found with this approach were:

1. Increased state-wide availability of services and uniformity of services, instead of varied program offerings from 22 separate utilities;
2. Reduced regulatory contentiousness and cost;
3. Reversal of a downward trend in utility program spending since 1993; and
4. Greater administrative and delivery effectiveness and efficiency

In 1999, the Vermont Legislature confirmed the authority of the PSB to create an Energy Efficiency Utility, set an annual funding cap for it of $17.5 million, and notably did not include a "sunset" of the authorization. The PSB ordered the creation of an Energy Efficiency Utility, adopting a negotiated settlement among the state's regulated utilities, the DPS, and business, consumer and environmental groups that spelled out many of the details of how the efficiency utility would operate. A "Request for Proposals" for contractors to act as the EEU was issued in October 1999, with the contractor selection made by the end of the year, and March 1, 2000 was established as the start date for full delivery of services.

The Energy Efficiency Utility (EEU) created to administer electric-ratepayer funded energy efficiency resource acquisition at a state-wide level operates under the name "Efficiency Vermont". It is funded by a small "energy efficiency charge" on all ratepayer bills. Services are delivered by a non-utility entity operating under a three year, performance-based contract with the Public Service Board. This performance contract has a fixed budget and 35 specified measures of performance. It provides technical assistance and financial incentives to Vermont households and businesses, to reduce energy costs with energy-efficient equipment and lighting and with energy-efficient approaches to construction and renovation. Unlike other state-wide non-utility administrators to implement efficiency efforts funded by system benefit charges, Efficiency Vermont had a broader scope of responsibility, accountability and independence. Efficiency Vermont provides a comprehensive portfolio of services and has achieved significant success in meeting its objectives. In 2007 and 2008, savings from energy efficiency measures more than offset the average underlying rate of electricity load growth.

11.2.2Administrative structure of Efficiency Vermont

The structure for Vermont's efficiency utility is illustrated in Figure 6.2. The model uses a "Contract Administrator," who is hired as an independent contractor by the PSB, and handles all day-to-day contract administration responsibilities on behalf of the PSB. It also includes a "fiscal agent," also an independent contractor, who receives EEC collections from the utilities and disburses funds against bills submitted by Efficiency Vermont upon approval by the Contract Administrator. It is notable that because the funds collected never become funds of the State, they are less exposed to redirection, and many procurement limitations associated with use of state funds are avoided.

The responsibility for the design, marketing and implementation of public-benefits energy efficiency in Vermont sits entirely with the PSB's contractor: Efficiency Vermont. This entity acts as an independent contractor to the State, under an extensive and detailed contract with the PSB. In addition to a detailed scope of work, the contract contains policy guidance, legal and accounting rules, and a lengthy set of negotiated measures of performance for the contractor. These performance indicators include quantified goals for MWh energy savings and Total Resource Benefits for the end of the initial three-year contract period, as well as over thirty additional activity milestones and result indicators. A financial performance incentive equal to approximately 2.9% of the contract value was agreed upon for 100% attainment of these performance results, which is far less than the typical rate historically allowed under most utility-administered arrangements.

The DPS has responsibility for review of the savings claims made by the Efficiency Vermont contractor each year. It engages with Efficiency Vermont in an ongoing process of review and update of prescriptive savings algorithms, and conducts an annual verification process of all savings claims. The DPS is also responsible for assessing and reporting on market potential, setting efficiency baselines, program evaluation, and making recommendations to the PSB on directions and priorities for the future of Efficiency Vermont.

The PSB also established an Advisory Committee composed of representatives from distribution utilities, consumers, the DPS, and others deemed necessary by the Board to provide substantive public and utility input on program design, annual reallocation of funds within programs, and other policy issues.

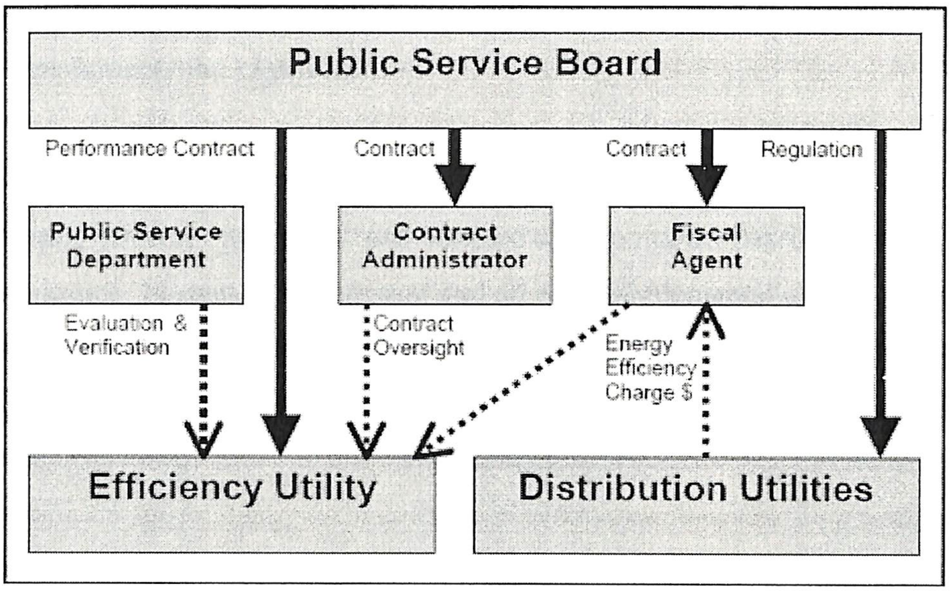


Figure 11.2 Structure of Vermont's Energy Efficiency Utility

11.2.3Efficiency Vermont's experience

Based on the Vermont's experience, the lessons learnt from the administrative structure, scope and objectives fall under following five areas:

• Achieving balance among multiple objectives: Sound energy resource portfolios inherently involve trade-offs to achieve both near and long term objectives. As a part of these portfolios, energy efficiency efforts also have multiple, potentially conflicting goals. Vermont's experience suggests that the use of carefully-crafted performance indicators in the context of a performance-based contract for delivery of measurable results can be a highly effective vehicle for seeing that multiple resource acquisition and policy goals are appropriately balanced in implementation as well as in design.

• Flexibility/Freedom in Design/Implementation: In case of Efficiency Vermont, the contractual/regulatory context allowed an unprecedented flexibility in how the contractor achieves goals. The PSB and the contractor operate under a mutual understanding that while the Board wants to understand and monitor the activities of Efficiency Vermont; its highest interest is in results. The benefits of this approach are:

o Increased flexibility to respond to changing markets in real time;

o Quick response to time-sensitive opportunities

o Reduced administrative cost associated with deliberation and formal approval processes over program changes; and

o Timely response to feedback mechanisms, including both evaluation findings and the contractor's implementation experience.

• Moving from 'Programs' to a 'Market Based Approach': Since 2003, Efficiency Vermont stopped offering "programs" and adopted a more market based approach. Service offerings, marketing, business development and all other implementation is now organized by broad and target markets that are based on customer perspectives, and often cross over traditional program (new construction vs. existing) or sector (residential vs. commercial) divisions.

• Addressing all sectors: Efficient Vermont has the responsibility for state wide energy efficiency resource allocation and results in all sectors. This allowed recognition of opportunities and implementation of efficiency efforts that cut across traditional sector definitions.

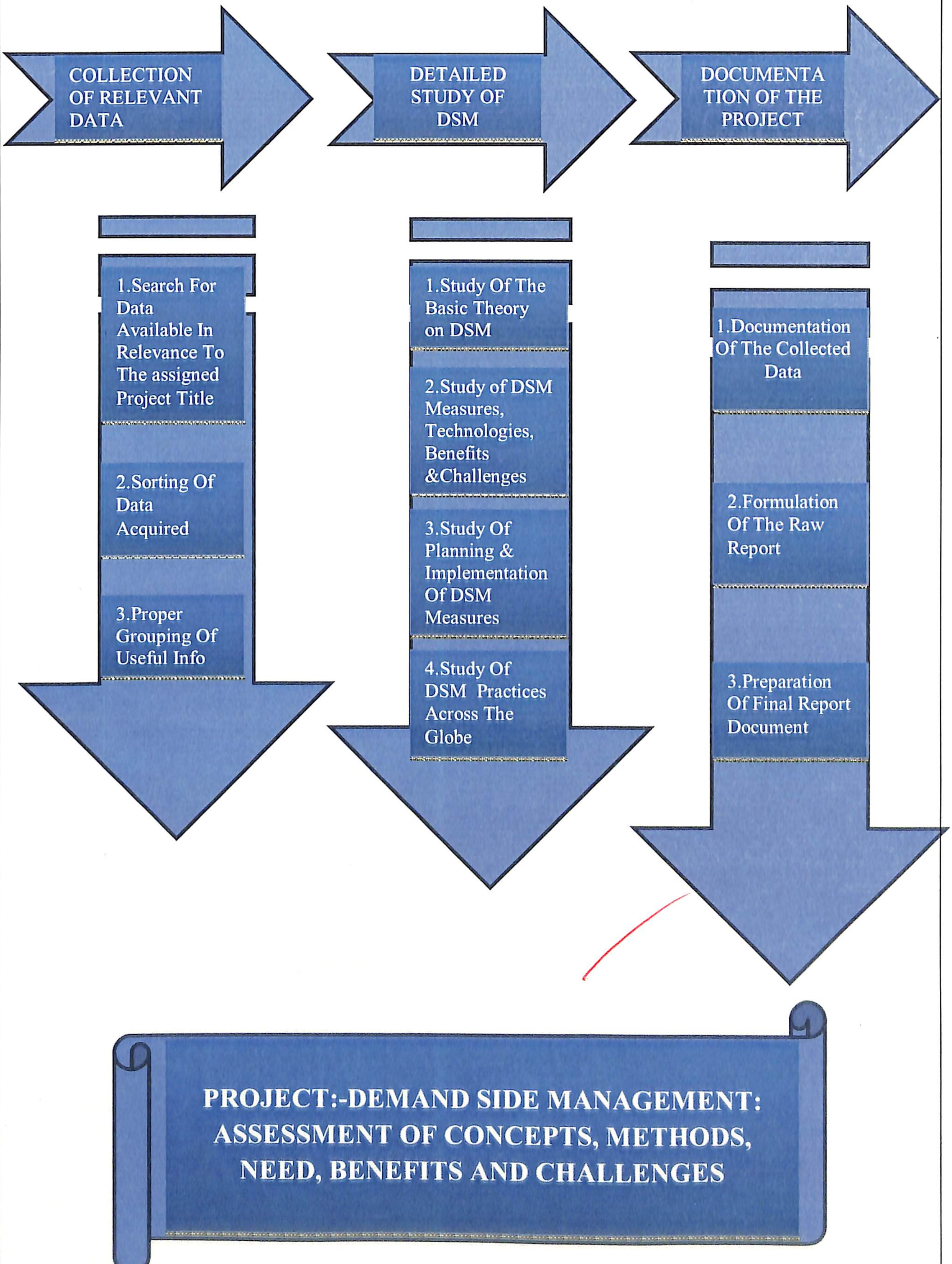
• Use of performance contract: The use of a competitively-bid, performance based contract with consequential impacts for delivering measurable results on a firm schedule has proven to be highly effective.

11.2.4Proposed structure of Efficiency Vermont

In Mid-2007, the PSB convened a process to consider alternatives to the EEU structure. Two specific reasons to consider modifying the structure are; one, problems associated with a short, fixed-term contract, and two, difficulties associated with the contractual relationship. The Vermont Legislature has supported moving to the new structure by passing enabling legislation and adding responsibilities for energy efficiency in the use of non-regulated fuels.

CHAPTER 12 : RESEARCH DESIGN, METHODOLOGY AND PLAN& INTERPRETATION OF RESULTS

12.1 Research Design



This study is an exploratory research to understand more about the demand side management, assessment of its concepts, methods, need, benefits and challenges.

12.2 Interview Procedures

In this survey research, the instrument that is utilized is a questionnaire format. Further the questionnaire method used is the self-administered questionnaire method.

The two most common types of survey questions i.e. closed-ended questions and open-ended questions are used in this report.

The survey was sent to respondents via e-mail. They were asked to fill in their responses and revert back via e-mail.

12.3SURVEY QUESTIONS WITH RESULTS

QUESTIONNAIRE FOR PROJECT REPORTON
DEMAND SIDE MANAGEMENT: ASSESSMENT OF CONCEPTS, METHODS, NEED, BENEFITS AND CHALLENGES

BACKGROUND INFORMATION OF THE RESPONDENTS
For Individual Respondent

Name of the respondent:	
Gender of the Respondent:	1. Male 2. Female
Literacy Status of the Respondent:	1.Post-Graduate 2.Graduate 3.Undergraduate
Designation:	

Organisation:	
Address and Contact Details	
Year(s) of Operation:	
Type of Organisation:	Industrial Government institution Private institution
City:	
State/Province:	

SECTION I: AWARENESS ABOUT DEMAND SIDE MANAGEMENT & ENERGY EFFICIENCY

S. No.	Questions	Options	Notes for Survey-ors
1.	Do you face any of the following supply related issues?	1. Frequent power cut 2. Voltage fluctuation 3. Both 4. None of the above	If select 4 skip to Q.7
	Result : 60% of the respondents faced both while 20% faced only Voltage fluctuation and another 20% faced Frequent power cuts.		
2.	During which part of the day do such problems occur?	1. Morning 2. Afternoon 3. Evening 4. Night 5. There is no definite time / persistent but irregular	
Result : 40% of the respondents faced power cuts during the night while 45% faced			

power cuts during the day while rest of the respondents said that there was no persistent time.			
3.	What electrical equipment have you installed at your place to deal with the problem of voltage fluctuation?	1. Voltage Stabilizer 2. Inverter 3. Any other, please specify	
Result : More than 65% have installed both Voltage Stabilizer and Inverter			
4.	What was the price (Rs.) of the equipment?		
Result : Rs.3500 - Rs,16000			
5.	Are you aware that judicious use of electricity will help in avoiding fluctuations?	1. No 2. Yes	If 'No' skip to Q.7
Result : 85% of the respondents answered "Yes"			
6.	If 'Yes', from which source did you get the information?	1. Media 2. Electricity distribution company 3. Seminar/Conference 4. Course curriculum in formal education 5.Awareness programmes 6. Own observation & practice 7. Any other, please specify	Choose more than one
Result : Above 80% got the information from Media or with their own observation & practice			
7.	Do you know that you can reduce your electricity bill/consumption by using energy efficient appliances such as compact fluorescent lamp (CFL) lights; energy-efficient pump sets etc.?	1. No 2. Yes	
Result : 67% of the respondents answered with "Yes".			

8.	If 'No', why do you think so?	1. Using more equipment's than before consumes the same amount of electricity 2. Not using the equipment's judiciously 3. Any other, please specify	
Result : Most of the respondents think that not using the equipment's judiciously increases the bill			
9.	Do you think that use of energy efficient equipment which consumes less electricity can help in addressing the problem of power cuts?	1. No 2. Yes	If 'No', don't proceed further
Result : 69% of the respondents answered with "Yes".			
10.	If 'Yes', have you started using energy efficient equipment?	1. No 2. Yes	If 'No' skip to Q.10
Result : All the respondents answered with "Yes".			
11.	If 'No', then what are the reasons for not using energy efficient equipment's?	1. Not available 2. Equipment cost is very high 3. Product quality is not very good/reliable 4. After sales service is not available/reliable 5. Not aware from where I can purchase it 6. Not sure about its benefits 7. Any other, please specify	
Result : Most of the respondents considered the equipment cost is very high .			
12.	How do you identify energy efficient products?	1.Star Rating 2. BEE labeling 3. Don't know 4. Any other, please specify	If 'Yes' skip to Q.4
Result : 70% the respondents identify energy efficient products through Star Rating while 18% are aware of BEE labeling.			
13.	What are the energy efficient product's that you use?		

<table>
<tr><td colspan="4">Result : Most of the respondents use CFL. LED , ACs & Refrigerators with STAR Rating</td></tr>
<tr><td>14.</td><td>Since how long have you been using these products?</td><td>1. Less than 03 months
2. 03-06 months
3. 06-12 months
4. Over 12 months</td><td></td></tr>
<tr><td colspan="4">Result : Over 65% of the respondents have been using the energy efficient product since more than 12 months</td></tr>
<tr><td>15.</td><td>What is your level of satisfaction with energy efficient products?</td><td>1. Extremely High
2. High
3. Medium
4. Low
5. Not satisfied</td><td></td></tr>
<tr><td colspan="4">Result : For 73% of the respondents the level of satisfaction is high while for 15 % it is Extremely High. Rest of the respondents considered it less satisfying.</td></tr>
<tr><td>16.</td><td>Please rank the following factors that affect your decision to purchase energy efficient products'? (1–Being the most important factors&5– Being the least important factors)</td><td>1. Brand name
2. Price
3. Star rating
4. Promotional offers
5. My neighbours and Friends are using it</td><td></td></tr>
<tr><td colspan="4">Result : Over 60% of the respondents give "1" preference to Star rating.
Around 54% gave "2" preference to either Price and rest of them gave "2" preference to the Brand name .
Most of them considered going with the option of Promotional offers or deciding the purchase based on the neighbour or friends' opinions as least important.</td></tr>
<tr><td>17.</td><td>Do you and your family members switch off electronic appliances when not in use?</td><td>1. No
2. Yes
3. Sometimes</td><td></td></tr>
<tr><td colspan="4">Result : Over 82% all the respondents answered with "Yes".</td></tr>
<tr><td>22.</td><td>Which of the following appliances are located at your current residence?</td><td>1. Dishwasher
2. Washing mc
3.Dryer
4.AC</td><td></td></tr>
<tr><td colspan="4">Result : Over 85% have Washing mc, Dryer, AC</td></tr>
<tr><td colspan="4">Result : Over 65 % answered said that it depends on the incentives.</td></tr>
<tr><td>26.</td><td>In order to correlate the information gathered using this survey with other</td><td>1. 15-25
2. 26-40
3. 41-55</td><td></td></tr>
</table>

	sources which age category do you fit in?	4. Over 56	
Result : 43% of the respondents lie in the age group of 26-40 yrs. 35% of the respondents lie in the age group of 41-55 yrs. 22% of the respondents lie in the age group of Over 56 yrs.			

SECTION II: ONLY FOR GOVERNMENT UTILITY of UPPCL/UPPTCL

1.	Does your utility currently offer customers energy efficiency/demand-side management programs?	1. No 2. Yes	If 'No' continue to Q.2 & Q.3 If 'Yes' continue to Q.4
Result : All of the respondents answered with a "Yes"			
2.	If no, which best describes your utility's plan?	1.To begin efficiency/demand-side management programs in the near future 2. No plan to begin efficiency/demand-side management programs	NA
3.	Please rate the following factors as to why your utility has not established such programs? (1–Being the most important factors&7– Being the least important factors)	1. Lack of time 2. Lack of personnel 3. Lack of knowledge 4. Lack of budget available/reliable 5. Lack of customer interest 6. Low energy costs 7. Lack of need 8. Other: (please specify)	NA

<table>
<tr><td>4.</td><td>What type of energy efficiency/demand-side management programs is your utility currently offering? Check all that apply.</td><td>1. Direct installation
2. Incentives/Rebates/Financing
3. Rate programs
4. Load control
5. Informational</td><td></td></tr>
<tr><td colspan="4">Result : Following 3 programs are currently being followed i.e.-
1. Direct installation
2. Incentives/Rebates/Financing
3. Load control</td></tr>
<tr><td>5.</td><td>How many load management employees does your utility currently employ?</td><td></td><td></td></tr>
<tr><td colspan="4">Result : 30% of the total strength is currently employed for the load management</td></tr>
<tr><td>6.</td><td>Is your utility participating in the energy efficiency/demand-side management programs?</td><td>1. No
2. Yes</td><td></td></tr>
<tr><td colspan="4">Result : All of the respondents answered with a "Yes"</td></tr>
<tr><td>7.</td><td>Which of these factors would motivate your utility to increase participation in energy efficiency/demand-side management Programs?
(1- Being the most likely&4– Being the least likely)</td><td>1. Mandatory conservation legislation
2. Higher power costs
3. Growing energy demand
4. Greater customer interest
5. Other (please specify):</td><td></td></tr>
<tr><td colspan="4">.
Result : Most of the respondents considered Mandatory conservation legislation, Higher power costs and Growing energy demand as the three most important factors.</td></tr>
<tr><td>8.</td><td>When evaluating an energy efficiency/demand-side management program, please rate the importance of the following factors?
(1- Being the most important&5– Being the least important)</td><td>1. Previous success (if applicable)
2. Assessing customer satisfaction
3. Reduction in peak demand
4. High energy savings to cost ratio
5. Ease in administration</td><td></td></tr>
</table>

Result : Over 88% of the respondents considered High energy savings to cost ratio and Reduction in peak demand as the most important factors. Over 88% of the respondents considered Assessing customer satisfaction and Previous success of the program is considered as the next important factors. Least preference is given to the "Ease in administration factor"			
9.	Please rate the energy efficiency/demand-side management programs that (according to you) are effective at reducing demand of a utility. (1- Being the most important&5– Being the least important)	1. Load Management 2. Renewable Energy 3. Energy Audits 4. Energy Education Information 5. Incentive Rates 6. Other (Please specify other programs that you shall offer):	
Result : Over 91% of the respondents considered Load Management, Renewable Energy and Energy Audits as the top most important factors. Other programs suggested are : Installing Capacitor Bank at distribution transformer level			
10.	Please rate the energy efficiency/demand-side management programs according to cost-effectiveness at saving energy. (1- Being the most important&6– Being the least important)	1. Load Management 2. Renewable Energy 3. Energy Audits 4. Energy Education Information 5. Incentives/Rebates 6. Rate programs 7. Other (Please specify other programs that you shall offer):	
Result : Over 83% of the respondents considered Load Management, Rate programs and Incentives/Rebates as the top most important factors Over 78% of the respondents considered Energy Audits and Renewable Energy is considered as the next important programs			

12.4Interview Procedures

In this survey research, the instrument that is utilized is a questionnaire format. Further the questionnaire method used is the self-administered questionnaire method.

The two most common types of survey questions i.e. closed-ended questions and open-ended questions are used in this report.

The survey was sent to respondents via e-mail. They were asked to fill in their responses and revert back via e-mail.

CHAPTER 13 : CONCLUSIONS AND SCOPE FOR FUTURE WORK

13.1 Conclusions

Demand Side Management, or "DSM" is the process of managing the consumption of energy, generally to optimize available and planned generation resources. Demand side management provides a range of technical, organisational and behavioural solutions to cut or decrease electricity consumption and demand.

Demand Side Management (DSM) is the implementation of policies and measures which serve to control, influence and generally reduce electricity demand. DSM aims to improve final electricity-using systems, reduce consumption, while preserving the same level of service and comfort.

DSM is recognized as a major solution in the fight against climate change since energy consumption and peak demand are reduced, installed capacity and distribution network extension can be avoided (or postponed), and less primary energy is required, reducing greenhouse gas emissions.

In addition to the benefits of DSM action such as reducing the electricity consumption issue or preventing the construction of new power plants and transmission lines, there are other significant benefits which should be mentioned:

- DSM actions are cost-efficient and bring substantial financial savings. DSM is one of the rare type of investments which generates its own economy;
- DSM actions can improve the wellbeing and comfort of end-users;
- DSM actions are win/win solutions with positive impacts for all actors involved :

local authorities (reduction of public electricity bill, emphasizing local resources, concrete contribution within the national and European commitments); end- users(reduction of electricity bill, improvement of service and comfort, concrete contribution to the national and European commitments, corporate citizenship),producers and suppliers (reduction of required investments for extension of power and transmission capacity, better public image, customer retention, concrete contribution to the national and European commitments)

Energy-efficiency improvements can slow the growth in energy consumption, save consumers money and reduce capital expenses for energy infrastructure. Additionally,

energy efficiency reduces local environmental impacts, such as water and air pollution from power plants, and mitigates greenhouse gas emissions. Energy efficiency standards and labelling programs provide enormous energy savings potential that can direct developing countries towards sustainable growth.
It now focuses well beyond oil crisis management on broader energy issues, including climate change policies, market reform, energy technology collaboration and outreach to the rest of the world.

As the industry considers major restructuring, the scope and character of electric utility DSM are likely to change. Market interventions designed to accelerate the commercialization of new energy-efficient technologies or practices may continue to be justified as a means of reducing market failures. At the same time, restructuring could greatly expand other demand-side activities including the use of real time pricing, time-of-use pricing, automated energy management, energy information services, and other services designed to expand the ability of customers to respond to changing price signals. Providing service packages that include generation, management of the price risks associated with competitive generation

13.2 Scope for future work

Demand-Side Management (DSM) is the selection, planning, and implementation of measures intended to have an influence on the demand or customer-side of the electric meter. DSM program can reduce energy costs for utilities, and in the long term, it can limit the requirement for further generation capacity augmentation and strengthening of transmission and distribution system.

13.2.1. Bureau of Energy Efficiency (BEE) and Ministry of Power (MoP) had introduced a number of schemes during 11th Five Year Plan for promotion of energy efficiency in India. Various activities under different schemes of BEE and MoP have resulted in savings in avoided power capacity of 7,415 MW (verified; till Dec 2010)and 250 MW (unverified for 4th Quarter of year 2010 – 11) and 3409 MW avoided power capacity savings is projected during the last year of the 11th Five Year Plan (2011-12).
system. BEE

would provide the technical assistance for establishment of DSM cells in the DISCOMs and capacity building of personnel of DSM cells for enabling them to undertake the following strategies and schemes of DSM in 12th Five Year plan:

(i) Load Survey

The questionnaire based surveys are the most commonly adopted tools to study the consumption pattern of the consumers by a utility. "Standard load survey techniques" need to be developed which may be adopted by the DISCOMs. Also it is envisaged that DISCOMs to develop utility/city level load profiles which may be uploaded on DISCOMs and BEE's DSM website (http://www.bee-dsm.in) on a periodical basis which can be utilized for DSM plans and for further analysis.

(ii) Load Strategies

Load strategies are to be adopted by electricity utilities to modify customer load profiles and thereby reduce their peak demands. Following Load management strategies may be demonstrated by DISCOMs/Utilities:

*** Demand Response**

Demand Response is an effort to create additional capacity during the peak hours, by involving voluntary load curtailment by consumers during peak hours or when requested by the distribution companies. The load curtailment can be achieved through implementing load reduction by Energy Efficiency or by load shifting measures.

*** Load Management Programmes**

□ Dynamic/Real Time Pricing: Based on real time system of supply & demand

□ Time-of-Use Rates: Customers are offered different rates for electricity usage at different times of the day.

□ Automated/Smart Metering: Implementing Dynamic/ Real Time Pricing or Time-of-use rate structure and billing accordingly.

□ Web-based/Communication System: This is a tool used along with the above to convey to the

customer about the prevailing demand, supply, prices on real time basis and the incentives and options for him, which are used by the customer to manage the demand.

(iii) Demonstration Studies

Direct installation programs that provide complete services to design, finance, and install a package of efficiency measures.

(iv) Advanced Metering

Advanced Meter has the capability of online communication, accurate measurements, local Intelligence, load connect-disconnect facility and consumer friendly display unit. Adoption of this technology will help distribution companies in implementing Demand Side Management specially Demand Response Activities.

(v) DSM Financing

The strategic value of DSM measures and energy efficiency lies in their ability to improve the financial cash flow of Indian utilities.

Moreover, DSM and Demand Response (DR) Activity are utilized to curtail the peak electricity demand. In other words, it helps to negate spending on generation, transmission and distribution infrastructure by curtailing the peak. Thus, it can be said that funds are freed up which would otherwise be utilized to meet the peak demand. At the National level, the load growth should be reviewed with and without DSM and the fund freed up because of lower peak growth should be used for DSM/DR activity. In other words, the DSM/DR should have a target (say 0.5% to 1%) of peak demand reduction and the net saving in infrastructure due to that should be used for DSM/DR activity. The total funds required for providing technical assistance for capacity building of DSM cells established by DISCOMs under 12th Five Year Plan is Rs. 300 crore.

13.2.2ENERGY CONSERVATION STRATEGY IN THE 12TH PLAN

The strategies adopted during the 11th Five Year Plan have started showing encouraging outcomes. It is necessary to carry forward the existing schemes as well as further strengthen the activities to accelerate the process of implementation of energy efficiency measures to achieve the desired energy savings.

Further, large scale energy savings can be realized through strengthening of the schemes in industrial, commercial, residential and agriculture sectors as well as expanding and reaching out to new areas. Projected electrical energy saving potential at the end of 12th Five Year Plan i.e during the year 2016-17 is 44.85 BU on the demand side (equivalent to 60.17 BU at Bus bar) and an additional energy saving equivalent of 21.3 mtoe in the industrial sector (including Thermal Power Stations(TPS) and Small and Medium Enterprises), Transport Sector and Energy Conservation (EC) award scheme.

13.2.3 HUMAN RESOURCE DEVELOPMENT PROGRAMMES

Human Resource Development (HRD) activities are required to meet the challenges of energy efficiency and sustainability together. A sound policy for creation, retention and up-gradation of skills of Human Resources is very crucial for penetration of energy efficient technologies and practices in the various sectors. Access to information and training is considered to be one of the most important barriers limiting the transfer of energy efficient technologies. BEE and SDAs have played a major role for stimulating a major change in the energy efficiency practices in the various sector of economy. BEE will continue the capacity building of energy professionals through national certification programme for Energy Manager/Energy Auditors. In addition to the HRD activities undertaken in each of the scheme of BEE and MoP, the following initiatives are also proposed to be under taken in the 12th Five Year Plan:

- Student awareness programs
- Training, skill up gradation and refresher training of energy managers and energy auditors
- Training, skill up gradation and refresher training of operators handling fuel fired furnaces and boilers.
- Inter-institutional networking in energy efficiency training
- Training of Power plant personals

The HRD plan is developed with both widths through general public awareness and student groups as well as depth through special training packages for sector specific energy efficiency of operators, energy auditors and managers. It meets the need of most of the sectors such as the power sector, SME, North East, agricultural, buildings, etc. The total budget proposed is Rs. 288 crores in the 12th Plan.

The target of energy saving which may be achieved in the terminal year 2016-17 of 12th Five year Plan as a consequence of Demand Side Management (DSM), Energy Efficiency and Energy Conservation schemes as proposed in the plan is expected to be 44.85 BU (at consumer side) which is equivalent to 60.17 BU at the Bus bar side. The equivalent avoided peaking capacity is estimated to be 12,350 MW at the end of the 12th five year plan. In addition to the electricity saving, total thermal energy saving equivalent to 21.30 million tonne of oil equivalent (mtoe) in the Industries & SME, Transport sector and Energy Conservation (EC) award is also expected to be achieved in the terminal year of 12th Plan.

Sr No	Sectors	Schemes	Total Fund requirement in schemes (Rs. In Crore)	Total Fund requirement in sector (Rs. In Crore)	Targeted Electricity Saving, BU	Targeted Thermal Fuel Saving, mtoe
1	Utility Based DSM	DSM Programme for Utilities	300	300	-	-
2	Industries	Industries	3767	4222	11.96	10.41
		SMEs	455		1.83	1.59
3	Residential Sector	Bachat Lamp Yojana	6	6	4.40	-
4	Equipment & Appliances	Standards & Labeling (S & L)	183	1653	10.40	4.30
		SEEP	1470		6.60	-
5	Agriculture Sector	Agricultural Demand Side Management	393	393	0.70	-
6	Commercial Sector	ECBC & Energy Efficiency in Existing Buildings	65	65	5.07	-
7	Municipal Sector	Municipal Demand Side Management	45	45	0.47	-
8	State Designated Agencies	SDA Strengthening	140	210	-	-
		State Energy Conservation Fund	70		-	-
9	National Awards, Painting & Awareness	National Awards, Painting & Awareness	100	100	3.42	5.00
10	Innovative Technologies/Areas	Energy Efficiency Research Centre	200	200	-	-
11	HRD	HRD	288	288	-	-
Total				7482	44.85	21.30
Total electricity saving at demand side, BU					44.85	
Total electricity saving at Bus bars, BU					60.17	

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